

SCIENCE.

FRIDAY, NOVEMBER 2, 1883.

OSWALD HEER.

OSWALD HEER, whose death in his seventy-fifth year we announced a fortnight since, was

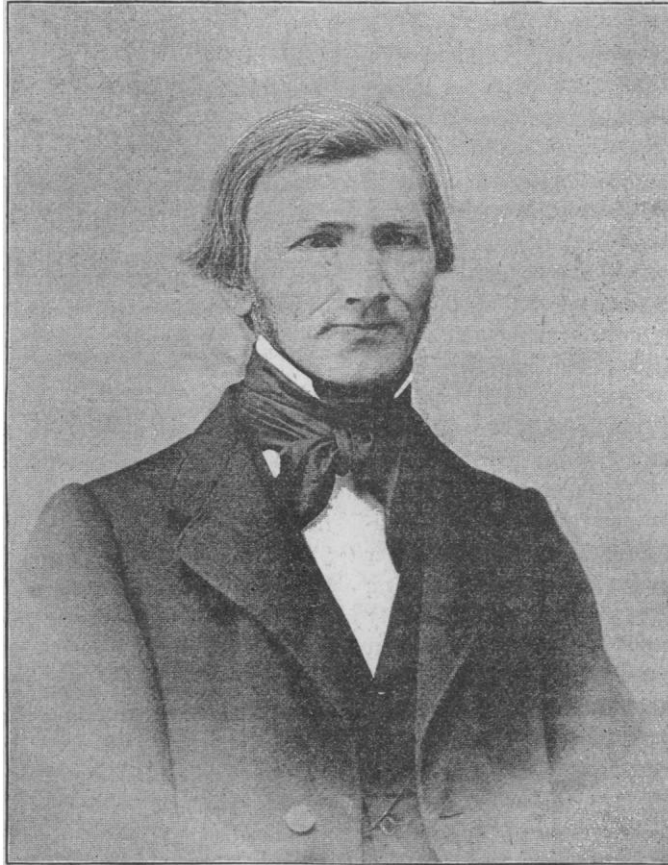
born in Glarus, Switzerland, Aug. 31, 1809. In 1828 he went to Halle to study theology and natural history. He began his career as a pastor at Glarus; and certain habits and manners of a clergyman clung to him throughout life, and traces of them may even be seen in his special paleontological writings. He soon gave up the ministry, and devoted himself exclusively to natural history; and we next find him settled in Zurich, where, in 1835, he founded the botanic garden, and became its director.

In the following year he was attached to the university as professor of botany and entomology,—the two studies which divided his time throughout his life. Later, about 1855, he transferred his alle-

giance to the Polytechnicum, an institution of world-wide fame, where he remained the rest of his life. In 1845 he founded and became president of the Zurich society of agriculture and horticulture. And for twenty years he

was a Rathsherr, or member of the Grand council of Zurich.

It was not until 1840 that he turned his attention to paleontology, studying first of all the fossil insects of Oeningen. This task he undertook at the instance of his friend Escher von der Linth. Knowing him from his childhood, Escher quickly perceived that a mind so delicately adjusted to observation, which no detail escaped, was well prepared for the difficult work of determining and classifying the numerous plants and in-



Oswald Heer
Dr. O. Heer

sects of Oeningen. It was a virgin field. Yielding to the solicitations of his friend, Heer bravely undertook the suggested work; and with scarcely an interruption, notwithstanding a constitution always delicate, he

brought out the remarkable and numerous memoirs which have given him a place among the first paleontologists of our time.

Soon after his return to Switzerland, Heer associated himself with Froebel (since renowned for his reforms in pedagogy) in the publication of a magazine under the title of '*Mittheilungen aus dem gebiete der theoretischen erdkunde*,' of which only four numbers were ever issued. In the first of these, in 1834, Heer printed two memoirs on the geographical distribution of insects and plants in the Swiss Alps, drawing his material mainly from his native canton,—memoirs which show, especially the longer one on insects, that he must have gathered his facts through patient, diligent observations of many years. These two memoirs appear to have been his earliest essays. He afterwards expanded the first into a long and better known memoir on the Swiss Coleoptera. These studies on geographical distribution formed an excellent basis for the paleontological work to which he was shortly to devote himself, one great value of which lies in his careful studies of the relations which the extinct insects and plants investigated bear to living forms in the same or other parts of the world. From this time on, not a year has passed without some sign of activity from this indefatigable student; and his last volume was only last month reviewed in our columns. At first the memoirs concerned mainly the transformations or distribution of Swiss Coleoptera, and the distribution of alpine plants; but from 1847, when his first memoir on the tertiary beetles of Europe appeared, his attention was directed almost exclusively to fossil insects and plants, especially those of the tertiary epoch; and it is here he has won his renown. The volume upon tertiary insects, issued between 1847 and 1853, opened a new world to science, and will forever remain the classic work on fossil insects. He brought to it a painstaking and faithful investigation, which in many cases will bear the closest scrutiny at the present time, notwithstanding the advance of entomology in the generation since elapsed. Finding that

the determination of fossil insects must depend largely upon a study of their wings, he made a special investigation of the neururation in living types, and proposed for the first time a uniform nomenclature for all orders of insects. From its burial in a memoir on fossil beetles, this scheme received little attention; but it remains to-day the most philosophical presentation of the subject.

Although his earlier paleontological papers were mainly devoted to insects, his attention was from the first attracted to the plants associated with them. And, the mass of insects from Oeningen disposed of, his memoirs now became more and more largely paleobotanical. To these he gave a living interest, from his discussions of the probable physical condition and climate of tertiary time, drawn from the data furnished by the plants. He was a strong believer in a miocene Atlantis. His first essay, dealing with ancient climates, was published in Giebel's *Zeitschrift* in 1859, and was afterwards expanded into a volume, which passed immediately through a much enlarged second edition (in French) by the assistance of his friend Gaudin.¹ Then followed that remarkable series of illustrated quarto memoirs, published in various countries and languages in London, Stockholm, St. Petersburg, Zurich, etc., in which the collections of various government expeditions are described and figured, and which he afterwards collected into the volumes which compose his '*Flora fossilis arctica*' (7 vols.), companion volumes to his '*Flora tertiaria Helvetiae*' (3 vols.) and '*Flora fossilis Helvetiae*.' His studies upon past climates were also carried into wider geologic fields, and resulted in his '*Urwelt der Schweiz*,' a living picture of the past of his native country, clothed in popular language. His imagination was here brought into play, and occasionally expressed itself in verse. This volume, issued in 1865, was translated into French by Gaudin (1875), and into English by Heywood (2 vols. 1876). To each of these editions he added supplementary matter,

¹ This last was also enriched by contributions from several naturalists, notably Matheron and Saporta.

and himself published a considerably enlarged German edition in 1878.

Heer, who, as we have said, was instigated to his paleontological studies by Escher, was glad to acknowledge his debt to his friend, whose most illustrious pupil he was. Rarely have such cordial relations existed between two men. He always spoke of Escher in terms of warm friendship and admiration, and always seemed to be asking, Did you ever know his equal? And, indeed, Escher merited his praise.

Without personal fortune, and very often obliged by illness not only to suspend his courses, but even to make expensive journeys to Madeira, Italy, etc., to regain his strength, Heer would have been greatly embarrassed but for his friend. Escher possessed a fair fortune, especially in the latter part of his life; and, being childless, he constantly sought opportunity to assist Heer, and, so far as possible, without his knowledge. Escher urged his gratuities with such delicacy and kindness that he seemed to be the one under obligation when his dear friend would accept his offerings. Escher recognized the worth of his *protégé*, appreciated the value of the services he was rendering to science, and welcomed with a beaming face every fresh memoir from Heer's pen.

Heer was a man of very retiring habits, being rarely seen in public, even on the street. His delicate health forbidding his travelling or making personal explorations, he lived in his study, where he received fossils from all parts of the world. Here he accumulated specimens from the arctic regions, from every country of Europe, from Asia, and from America. Here in the midst of cabinets, and with books piled up on every side, he passed all his time, yet always receiving his geological friends with manifest pleasure. Many a scientific man came here to visit the illustrious paleontologist,—Leopold von Buch, Sir Charles Lyell, von Hauer, Geinitz, Fraas, Oppel, Sismonda, Ramsay, Falconer, Pictet, Studer, Merian, Agassiz, de Zigno, Mojsisovics, Gumbel, Schimper, Zittel, Schmidt, Abich, etc. While he was asso-

ciated with Heer in the Polytechnicum, Jules Marcou was a visitor almost daily, and relates how, with a pleased and contented smile, Heer always greeted him after his fashion, grasping his hand in both of his. Reclining on a sofa (for Heer could only work a brief time without seeking rest), he would gladly converse for an hour or two upon geological topics and the numerous problems still requiring solution.

We have said he undertook no explorations; yet, in the winter of 1854–55, he visited Madeira for his health, in company with Ziegler and Hartwig. Several memoirs resulted from that visit; and in 1861, with his friends Escher and Merian, he visited Paris, London, the Isle of Wight, and Holland. An unusual exception was his accompanying his friend Marcou on short journeys to Oeningen, Schambelen, Dürnsten and Utznach, and Hohe Rhonen,—favorable localities for fossil plants and insects.

Heer worked quite alone, unaided by others; and he never worked in collaboration with other men, unless we may except the late C. T. Gaudin of Lausanne, who translated several of his important works, and in one at least, that on the climate of the tertiary epoch, may be said to have been a collaborator. Heer so called him. Indeed, it is possible, that had Gaudin not died in the flower of his age, eighteen years ago, he would have worked still further in concert with Heer, and given his works a wider circulation. Heer also found an assistant, as excellent as devoted, in his daughter, especially during the last twelve years of his life, many of which, after the disease which attacked him in 1872, he passed upon his bed. She was ever ready to place before him specimens, books, plates, descriptions, manuscripts. Always by his side, all his wishes were cared for by her in the most assiduous and intelligent manner.

A man more lovable, more sympathetic, a life more laborious and pure, one could scarcely imagine. As a man, he possessed the same irresistible attraction to all who came under his influence as that which characterized the late Lady Lyell.

The portrait given here has been photo-engraved from a photograph taken in 1864 by Heer's brother, kindly lent for the purpose by Professor Jules Marcou. The signature is taken from a letter addressed to the writer, under date of Aug. 13, 1883.

A HEARING OF BIRDS' EARS.¹—III.

SECTION of bone is required for further examination of the ear parts. There being no mastoid affair to be considered as such, we may proceed directly to the 'petrous part of the temporal' (the periotic or petrosal bone); the otocrane, or otic capsule, enclosing the essential organ of audition just as the eyeball does that of vision, or the ethmoid bone that of olfaction. None of this bone is ordinarily recognizable on the outside of the skull; though in the embryo that part which is in especial relation with the posterior semicircular canal appears to a slight extent upon the occiput. The foundation of the bone is laid very early in cartilage; traces of the cochlea and canals being visible in the chick at the fifth day of incubation, if not sooner, in the primitive cartilaginous *basis cranii*, — the parachordal plate of cartilage on each side of the notochord. On longitudinally bisecting the adult skull, or otherwise gaining access to the brain-cavity, the whole cerebral surface of the petrosal bone is brought into view, as in fig. 4, *po*, *op*, *ep*. In a skull of any size, as that of an eagle (from which my description will be mainly derived), there is no difficulty in making out the parts, although the periphery of the petrosal is completely consolidated with surrounding bones. The petrosal or periotic bone consists of three distinct bones, which in some animals may remain long or permanently separate, or be consolidated with surrounding bones and not with one another. To see them it is usually necessary to examine a young skull, like that figured. These are the *pro-otic*, *po*; the *opisthotic*, *op*; the *epiotic*, *ep*. In the present case of the adult eagle, they are absolutely fused with one another, as well as with contiguous bones. The consolidated petrosal appears as an irregular protuberance upon the inner wall of the brain-cavity, much as the human petrous bone protrudes between posterior and middle cerebral fossae. It appears to be much more extensive than it really is, because the superior semicircular canal, too large to be accommodated in the petrosal, invades the occipital bone, — the track of the canal being

sculptured in bas-relief, — as at *asc*, fig. 4. Behind this semicircular trace, the deep groove of a venous sinus (*sc*) is engraved upon the bone, throwing the track of the canal into still stronger relief. The top of the petrosal and contiguous occipital surface floors a fossa which lodges the enormous optic lobes (*corpora bigemina*) of the brain; in the eagle partly divided from the general cavity for the cerebral hemisphere by a bony tentorium, like that which in some mammals separates the cerebellar from the cerebral fossae. On the vertical face of the petrosal, or on the corresponding occipital surface, is a large smooth-lipped orifice leading to a tongue-like excavation which lodges the flocculus of the cerebellum, and would therefore seem to correspond to that slight chink of the human petrous bone, near the *meatus internus*, which lodges a process of the *dura mater*. In front, between the petrosal and the alisphenoid (or in the apposed border of one or the other of these bones), is a considerable foramen, — the exit of the second and third divisions of the trifacial (figs. 1 and 4, the hole marked 5). Below the petrosal, between opisthotic and exoccipital, near the *foramen magnum*, is a foramen (which may be subdivided into foramina) representing the human *foramen lacerum posterius*, for transmission of the pneumogastric, etc. (fig. 4, the hole marked 8). Thus, as always, the bony auditory capsule lies between the exits of the third division of the trifacial and the pneumogastric. The general space under description is continued to the margin of the *foramen magnum* by the exoccipital bone (fig. 4, *eo*). Now, on the vertical face of the petrosal itself, and in the pro-otic part, far behind the foramen marked 5 in fig. 4, considerably above that marked 8, will be seen the large smooth-lipped orifice of the *meatus auditorius internus*, marked 7 in the figure. Here enter, as usual, both *portio dura* and *portio mollis* of the old seventh pair of cranial nerves. At the bottom of the meatus are at least two openings, small, but separate from each other. A bristle passed through the upper (anterior) one of these traces the course of *portio dura* (the facial nerve) through the fallopian aqueduct ('nerviduct,' it would be better called), and emerges in the tympanic cavity near the eustachian orifice. This orifice of exit of the facial is virtually a 'stylo-mastoid' foramen, though within the tympanic; for the nerve burrows through no more bone in reaching the surface of the skull. A bristle passed through the other one of the two foramina at the bottom of the meatus practically traces the course of the *portio mollis*, or auditory nerve,

¹ Concluded from No. 38.

and can also be made to come out into the tympanum, either through the vestibular or cochlear opening (*fenestra ovalis* or *fenestra rotunda*). In the dry skull, either passage is easily made without breaking down, and apparently without meeting any bony obstacle.

If, now, the whole petrotic mass be cut away from the rest of the skull with a fine saw, and then divided in any direction, the bony labyrinth and essential organ of hearing can be studied. It is best to make the section in some definite plane with regard to the axes of the skull, — the vertical longitudinal, or vertical transverse, or horizontal, — as the disposition and relations of the contained structures are then more readily made out. Four or five parallel cuts will make as many thin flat slices of bone, affording eight or ten surfaces for examination. The whole course of the labyrinthine structures can be seen in sections, which, put together in the mind's eye, or held in hand a little apart, and visibly threaded with bristles, afford the required picture very nicely. At first sight, the unpractised eye will recognize nothing but confusion, — a bewildering maze of bone. All this cancellated structure or net-work, however, is pneumatic; the open-work tissue of bone containing air derived from the tympanum, and having nothing to do with the auditory cavities proper. Parts of the bony labyrinth will soon be recognized by their smooth, firm walls and definite courses, as distinguished from the irregular interstices

of bone-tissue. They are, as usual, a central vestibular cavity, with its utricular recess; three semicircular canals; and the cochlear cavity, projecting downward like a beak (see figs. 5 and 6, the membranous labyrinth, to which the incasing bony cavities closely conform). According as the sections have been made, numerous cross-cuts of the canals will

be seen here and there as circular orifices; the canals themselves lying curled like worms in the petrosal and occipital substance, their ends converging to the central vestibular cavity. As compared with those of man, the parts are of great size in a bird: in the eagle, for example, the whole affair is as large as the end of one's thumb, the whole length of the superior canal is an inch or more, and its calibre, I should judge, is absolutely about as great as in man. The cochlea, though not comparatively diminutive, is in an undeveloped state, as far as complexity of structure is concerned, — ligulate or strap-shaped, a little curved on itself, but making no whorl.

This is substantially as in all Sauropsida (birds and reptiles), for the cochlea does not coil into a helix until we reach Mammalia. The tongue-like affair is simply as if a part of the first whorl of a mammal's cochlea very incompletely divided into *scala vestibuli* and *scala tympani* by car-

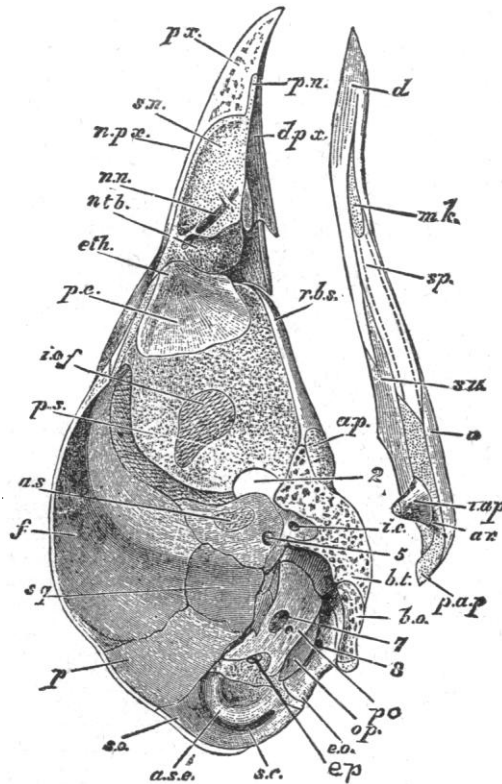


FIG. 4. — Ripe chick's skull, longitudinal section, viewed inside, $\times 3$ diameters. (After Parker.) In the mandible are seen, — *mk*, remains of meckelian rod; *d*, dentary bone; *sp*, splenial; *a*, angular; *su*, surangular; *ar*, articular; *iap*, internal articular process; *pap*, posterior articular process: in the skull, — *pn*, the original prenasal cartilage, upon which is moulded the premaxillary, *px*, with its nasal process, *np*, and dentary process, *dp*; *sn*, septo-nasal cartilage, in which is seen *nn*, nasal nerve; *ntb*, nasal turbinate; *eth*, ethmoid; *pe*, perpendicular plate of ethmoid; *iof*, inter-orbital foramen; *ps*, pre-sphenoidal region; *2*, optic foramen; *as*, alisphenoid, with *5*, foramen for divisions of the fifth nerve; *f*, frontal; *p*, parietal; *so*, super-occipital; *asc*, superior semicircular canal; *sc*, a sinus (venous) canal; *ep*, epiotic; *eo*, exoccipital; *op*, opisthotic; *po*, pro-otic, with *7*, *meatus auditorius internus*, for entrance of seventh nerve; *8*, foramen for vagus nerve; *bo*, basi-occipital; *bt*, basi-temporal; *ic*, canal by which carotid artery enters brain-cavity; *ap*, basi-pterygoid process; *ap* to *rb*, rostrum of the skull, being the parasphenoid bone underflooring the basi-sphenoid and future perpendicular plate of ethmoid.

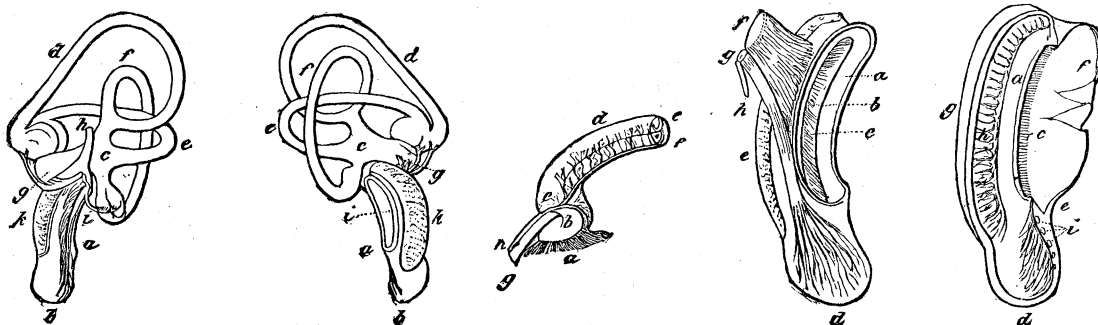
tilaginous structures representing a modiolus and its lamina, proceeding from the bony bar or bridge between *fenestra ovalis* and *fenestra rotunda*. These are the external (*a*) and in-

ternal (*b*) cartilaginous prisms shown in figs. 8 and 9. The cochlea ends with a saccular part, termed the 'lagena.' Details of the soft parts—membranous, vascular, and nervous—will readily be made out from Professor Ibsen's beautiful figures, here reproduced (figs. 5, 6, 8, 9), with ample explanatory text.

The vestibule hardly requires special description, after examination of figs. 5 and 6. In the eagle, if its irregularities of contour were smoothed out, it would about hold a pea. Its utricular recess (*g*) is well developed.

In the language of human anatomy, the three semicircular canals are the anterior or superior vertical, the posterior or inferior vertical, and the external or horizontal; and the planes of their respective loops are approximately perpendicular to one another in the

tal one, *e*, which tilts down backward. The verticality of the planes of *d* and *f* is preserved. The canals in birds might be better known as the superior (*d*) and inferior (*f*) vertical, and horizontal (*e*); though it is not probable, viewing the great variation in the axes of this part of the skull, that any terms descriptive of *direction* will apply perfectly to all birds. Whatever its inclination backward, there is no mistaking *d*, which is much the longest of the three, looping high over the rest, exceeding the petrosal, and partly bedded in the occipital, with the upper limb bas-relieved upon the inner surface of the skull (fig. 4, *asc*). The one marked *f* loops lowest of all, though little, if any of it, reaches farther back than *d*; it is the second in size, and quite circular (rather more than a semicircle). Its upper limb joins



FIGS. 5, 6.—Membranous labyrinth of *Haliastur albicilla*, $\times 2$. *a*, *b*, cochlea; *b*, its saccular extremity (or lagena); *c*, vestibule; *g*, its utricle; *d*, anterior or superior vertical semicircular canal; *e*, external or horizontal semicircular canal; *f*, posterior or inferior vertical semicircular canal; *h*, membranous canal leading into aqueduct of the vestibule; *k*, vascular membrane covering the *scala vestibuli*. Opposite this, at *i*, are seen the edges of the cartilaginous prisms in the *fenestra rotunda*: from the edges of these cartilages proceeds the delicate membrane closing the opening of the cochlea (not shown in the figure).

FIG. 7.—Part of the superior vertical semicircular canal, showing its ampulla, nerve of ampulla, artery, and connective tissue of the perilymph, $\times 3$. *a*, that part of the vestibule (alveus) next to the ampulla; *b*, the dilatation of the ampulla at its vestibular opening; *c*, where it passes into the canal proper; *d*, the canal, furnished with connective tissue of the perilymph along its concave border and sides, as appears clearly at the sections *e* and *f*; *g*, nerve of the ampulla; *h*, artery of the connective tissue, running beneath it, remote from the wall of the duct.

FIG. 8.—Cochlea, $\times 3$. *a*, external, *b*, internal, cartilaginous prism; *c*, membranous zone; *d*, saccular extremity of the cochlea, or lagena; *e*, vascular membrane; *f*, auditory nerve, its middle fascicle penetrating the internal cartilaginous prism, to reach the membranous zone by its terminal filaments; *g*, auditory nerve, its posterior fascicle running to the most posterior part of the lagena; *h*, filament to ampulla of posterior or inferior vertical semicircular canal.

FIG. 9.—Section of the cochlea. *a*, vestibular surface of external cartilaginous prism, extending into *d*, the lagena; *c*, section of the membranous zone; *e*, Huschke's process of the fenestra, which, with the margins of the cartilaginous prisms, affords attachment to the blind sac, *f*, occluding the fenestra of the cochlea; *g*, spongy vascular membrane of the *scala vestibuli*; *h*, auditory lamellae of Treviranus; *i*, canals in posterior wall of the lagena, by which the nervous filaments enter its cavity.

(From Ibsen's *Anatomiske undersøgelser over Ørets Labyrinth*. Kjöbenhavn, 1881, p. 17, pl. 1, figs. 13–17.)

three planes of any cubical figure. In birds, these terms do not apply so well to the situation of the canals with reference to the axes of the body, nor to the direction of their loops; neither is their mutual perpendicularity so nearly exhibited. The whole set is tilted over backward to some extent, so that the anterior (though still superior) canal, *d*, in figs. 5 and 6, loops back beyond either of the others; its anterior limb is also straightened out. The posterior (though still inferior) canal, *f*, loops behind and below the horizon-

tal one, *e*, which tilts down backward. The verticality of the planes of *d* and *f* is preserved. The canals in birds might be better known as the superior (*d*) and inferior (*f*) vertical, and horizontal (*e*); though it is not probable, viewing the great variation in the axes of this part of the skull, that any terms descriptive of *direction* will apply perfectly to all birds. Whatever its inclination backward, there is no mistaking *d*, which is much the longest of the three, looping high over the rest, exceeding the petrosal, and partly bedded in the occipital, with the upper limb bas-relieved upon the inner surface of the skull (fig. 4, *asc*). The one marked *f* loops lowest of all, though little, if any of it, reaches farther back than *d*; it is the second in size, and quite circular (rather more than a semicircle). Its upper limb joins

greatest convexity, farthest away from the vestibule. This decussation of *e* and *f*, like the twining inosculation of *f* and *d*, is well known. It may not be so generally understood that there is (in the eagle; I do not know whether or not in birds generally) a *third* extra-vestibular communication of the bony canals. My sections show this perfectly. The great loop of *d*, sweeping past the decussation of *e* and *f*, is thrown into a cavity common to all three. Bristles threaded through each of the three canals can all be seen in contact, crossing one another through this curious extra-vestibular chamber. I call it the *trivia*, or 'three-way place.' It is just where, in fig. 6, the three membranous canals decussate, — midway between the letters *e*, *f*, and *c*. It does not, of course, follow, that the contained membranous canals intercommunicate here, and it appears from Ibsen's figures that they do not. The ampullar dilata-tions of the ends of the canals are well marked. The anatomy of associate soft parts is explained to some extent under fig. 7.

The endolymph may contain otoliths similar to those great concretions called 'ear-stones' in fishes. The equilibrating function of the labyrinth and its fluid appears to have been determined mainly from experiments upon birds. The apparatus may be likened to the glass tubes filled with water and a bubble of air, by a combination of which a surveyor, for example, is enabled to adjust his theodolite true; for a bird somehow knows how the liquid stands in these self-registering levelling tubes, and adjusts itself accordingly. Observations made upon pigeons show, that, "when the membranous canals are divided, very remarkable disturbances of equilibrium ensue, which vary in character according to the seat of the lesion. When the horizontal canals are divided, rapid movements of the head from side to side in a horizontal plane take place, along with oscillation of the eyeballs, and the animal tends to spin round on a vertical axis. When the posterior or inferior vertical canals are divided, the head is moved rapidly backwards and forwards, and the animal tends to execute a backward somersault, head over heels. When the superior vertical canals are divided, the head is moved rapidly forwards and backwards, and the animal tends to execute a forward somersault, heels over head. Combined section of the various canals causes the most bizarre contortions of the head and body." — (Ferrier, *Funct. of the brain*, 1876, p. 57.) Injury of the canals does not cause loss of hearing, nor does loss of equilibrium follow de-

struction of the cochlea. Two diverse though intimately connected functions are thus pre-sided over by the acoustic nerve, — audition and equilibration.

The wonderful and endlessly varied songs of birds may acquire for us a new significance, now that we understand the mechanism by which these engaging creatures derive pleasure from their own music. Though no two things can well be conceived more different than an anatomical disquisition and a bird-song, either may be made to subserve the purpose of a truer appreciation of the other; and there may be physiological aspects of even a 'Christmas carol.'

ELLIOTT COUES.

Washington, Christmas, 1882.

WHIRLWINDS, CYCLONES, AND TORNA-DOES.¹—I.

THE general circulation of the winds is at times interrupted by local and temporary disturbances of very varied size and strength, to which the general name of 'storms' is given. Their most constant features are, a more or less pronounced inward spiral whirling of the air near the ground, feeding an up-draught at the centre, and an outflow above; and a progressive motion from place to place, along a tolerably well-defined track. Clouds, and generally rain as well, accompany the larger storms.

It is our object to explain how these disturbances arise, to examine the causes and methods of their peculiar action, and to study their distribution in time and place. With this end in view, the small dust-whirlwinds that commonly arise in the hot dry air of deserts will be first considered. Next will come the great hurricanes and typhoons of the tropical seas, and the less violent rotary storms of our own latitudes, all of which may be grouped together as cyclones. The tornadoes and water-spouts, showing a peculiar concentration of power over a very limited area, will be discussed last.

The dry whirlwinds in flat desert regions suddenly interrupt the calmness of the air, and begin turning, catching up dust and sand, and carrying them upwards through the spiral vortex to a height of many hundred feet. They are therefore not at all like those whirls formed about our street-corners at the meeting of opposing currents of blustering wind, or the eddies of greater strength seen in windy mountain regions; for they arise in a time of quiet, and begin their motion without apparent cause. Hence we must, at the outset, inquire into the

¹ Based on a series of lectures delivered at the Lowell Institute, Boston, in January, 1883.

condition of the atmosphere when it lies at rest, examining it especially with regard to the kind of equilibrium that then exists, and the changes necessary to produce a tendency to motion.

When the air is at rest, it is normally densest and warmest next to the earth's surface, and becomes thinner and cooler at successive altitudes above it. It is denser below because the earth's attraction pulls it down, and compresses the lower layers by the weight of the upper ones. It is warmer below, mainly because the air gets nearly all of its heat by contact with, or radiation from, the warm earth, and not directly from the sun's rays, which pass through it with but little obstruction. The average rate of upward cooling, determined by many observations on mountains and in balloons, is about one degree F. for every three hundred feet of ascent. In this restful condition let us take a block of the dry air (the effect of the presence of water-vapor will be considered with the storms at sea) from the earth's surface, where the temperature is, say, 60° (fig. 1), and lift it up three hundred feet,

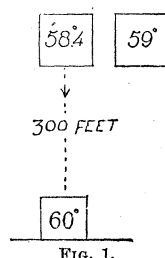


FIG. 1.

to where the temperature is one degree less, or 59°. The block of lower air expands as it rises, because it is pressed on by less atmospheric weight,—less, at least, by the weight of three hundred feet of air; and, in thus expanding, it is cooled mechanically. It has been shown that this mechanical cooling of an ascending mass of dry air amounts to one degree F. in a hundred and eighty-three feet of ascent, whatever its initial temperature; so that in this special case the block is cooled by 1.6°, and its temperature is reduced to 58.4°. Now, let us compare it, when thus expanded and cooled, with an equal-sized block of air beside it, whose temperature is 59°. Evidently, of these two blocks of the same volume, and at the same pressure, the cooler will be the heavier. The block brought up from the surface, and now at a temperature of 58.4°, will weigh more than the air at 59° beside it, and hence it will tend to sink; and it must sink all the way down to its original level before it finds any air as heavy as itself. In this imaginary experiment we have disturbed the arrangement of the normal, quiet atmosphere; and the disturbed mass returns to its original position as soon as freed from the constraining force. Such an atmosphere is therefore in a condition of stable equilibrium, like a rod hung by its upper end, which

is opposed to any change in its position, and, when displaced, tends to return to its original attitude.

Evidently, when a whirlwind springs up in the calm air of a desert, as is so often the case, the atmosphere cannot possess this normal stability: for then there would be no temptation to any such disturbance; the air would prefer to stand as it is. Before the whirlwind can arise, there must have been a change to a condition of unstable equilibrium, in which the air, like a rod balanced on its lower end, is ready to move on small provocation; and we have now to look for the cause of this change. To be guided properly in the search, the conditions necessary and antecedent to the formation of the whirls must be examined. They are, that the whirls occur generally in level, barren, warm regions, in quiet air, and only in the daytime after the sun has risen high enough to warm the sandy ground, and the air next to it, to a rather high temperature. As the first and second of these conditions may be present at night as well as by day, it must, without doubt, be the heat from the sun that disturbs the quiet equilibrium into which the air tends to settle, and, by warming the lower layers, causes a departure from the ordinary stable condition of rest.

Let a case be supposed: the sun has warmed the lower air of the first example to a temperature of 90° (fig. 2), while the air three hundred feet above the desert sands has, in virtue of its diathermance, risen only to 70°; so that there is now a difference of twenty degrees between these two layers. If we here repeat the experiment of carrying a block of surface-air to a height of three hundred feet, it is again mechanically cooled 1.6°, so that its temperature is reduced to 88.4°; and now, comparing it with

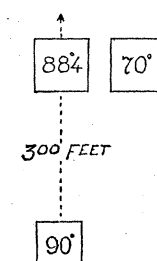


FIG. 2.

an equal volume of adjoining air at 70°, the latter is evidently the heavier, and therefore the block of air brought up from the surface, instead of tending to sink, as in the first case, tends strongly to rise farther, and continue the motion given to it. In other words, the air is now in a condition of unstable equilibrium: it is ready to upset and re-arrange itself. The lower layer may be compared to a film of oil balanced beneath a quiet sheet of water: a little disturbance would cause the two liquids to change places, and the oil would rise through the water, draining itself upwards.

In such a condition as this, the desert-whirls may begin. It is clearly not necessary, in order to produce this result, that the vertical decrease of temperature should be as much as twenty degrees in three hundred feet, as in the case just assumed. In order to pass from the stable equilibrium, through the indifferent to the unstable equilibrium, it is sufficient, in dry air, that the vertical decrease should be greater than 1.6° in three hundred feet, or greater than one degree in one hundred and eighty-three feet. Moreover, it is important to notice, that, according to this theoretical explanation, the condition of indifferent equilibrium is passed before the surface-air is, as Franklin (1753) and Belt (1859) have said, specifically lighter than that above it. This would require a temperature difference of at least 5.6° F. in three hundred feet. It is sufficient that the surface-air shall be potentially lighter, though absolutely (before any motion takes place) heavier, than the higher layers, as Reye first showed (1864); or, in other words, stable equilibrium is lost, and indifferent equilibrium reached, when the surface-air is just enough warmer than any layer above it to make up for the change of temperatures produced in equalizing their densities. Any further excess of surface-warmth brings about theoretic unstable equilibrium. On the other hand, whirlwinds of decided activity will not be formed until the difference of temperature is much in excess of the narrow limits just given, the strength of the up-current increasing with its excess of warmth. Motion of the atmosphere caused by small differences of temperature would be very gentle, and would be perceived only in the 'boiling' of the air, often seen in summer-time over the brow of a hill.

It must be, then, the sun's heat, as was supposed, that destroys the normal stable equilibrium of our atmosphere; and to a disturbance of this kind we can refer more or less directly all storms, and, indeed, all winds that blow about the earth. Without the heat that is constantly showered down on us, we should soon gravitate into a lifeless condition of stable equilibrium, chemical, organic, and physical, and there remain in endless death. But the sun allows no such inactivity on its attendant planets: it keeps them alive and at work.

(To be continued.)

THE FRENCH ECLIPSE EXPEDITION.

P. J. JANSSEN, the leader of the French expedition which visited Caroline Island to observe the solar eclipse of May 6, has made a report to the French

academy of sciences, which is published in full in the *Bulletin hebdomadaire de l'Association scientifique*, no. 181. It contains, first, an interesting account of the voyage to Caroline Island, and a brief description of the island, with the difficulties encountered in landing the instruments; then follows a statement of the instrumental outfit and the plan of observations. The search for intra-mercurial planets was assigned to Messrs. Palisa and Trouvelot. The former used an equatorial of 0.16 m. aperture, having a short focus and large field: the latter was provided with an equatorial of the same size, which had a finder of 0.08 m. aperture, thus giving the observer two telescopes. The finder had a field of $4^{\circ}.5$, and was used in examining the region in the vicinity of the sun, while the larger instrument was intended to give the position of any strange object that might be noted by means of its position-circles. In order to avoid the necessity of reading the circles, an attachment was made to both right ascension and declination circles, by which fine marks could be made upon the circles and verniers by the observer's assistants, and the corresponding readings determined at leisure. The finder was also furnished with a reticule containing cross-threads, and a position-circle for use in noting the appearance of the corona, to the drawing of which Mr. Trouvelot gave a portion of the time of the total phase.

The search for intra-mercurial planets was also conducted by the aid of photographic apparatus, which Mr. Janssen thus describes:—

"At my order, Mr. Gautier had prepared an equatorial mounting with an hour-axis two metres long, carrying a strong and large platform, upon which were fastened the following photographic apparatus: a large camera having a lens of eight inches (0.21 m.), made by Darlot, giving a field of 20° to 25° (plate of 0.40 m. by 0.50 m.), and designed for photographing the corona and the region about the sun with reference to the stars there found; a second camera, with a Darlot lens of six inches (0.16 m.), giving a field of 26° to 35° (plate of 0.30 m. by 0.40 m.), for the same purpose; and a very fine apparatus by Steinheil, for studying the corona. A second mounting carried several cameras with lenses of four inches (0.10 m.), giving a great amount of light, and designed to determine by very sensitive plates what are the limits of the corona, — an apparatus of great light-power, the exposure lasting during the whole of totality."

For spectrum analysis the following apparatus was employed: "a [reflecting] telescope of 0.50 m. aperture, having a very short focus (1.60 m.), and supplied with a direct-vision spectroscop of ten prisms; the slit of the spectroscop could be placed at different position-angles, and rapidly opened or closed, at the pleasure of the observer. An excellent finder, supplied with a reticule, was placed near the spectroscop, and distant from it by such an amount, that, when one eye had fixed upon some point of the corona in the finder, the other could obtain the spectroscopic analysis of this point." There was also attached to this telescope a biquartz polariscop by Prazmowski, and a spectroscop for showing Respighi's rings. A

spare mirror of 0.40 m. diameter was carried as a reserve, but was not brought into use, as, by great care, the first was kept uninjured, in spite of the frequent rains and the moisture of the climate.

Mr. Janssen gives the following condensed report of his own observations, drawn up immediately after the observations, in accordance with the plan by which all the observers of the party were governed:—

“My observations were of two classes,—optical and photographic. The optical observations were principally designed to determine whether the coronal spectrum consists of a continuous spectrum as a background with bright lines, or if the Fraunhofer lines exist there generally (an investigation made especially with regard to the question of extra-solar cosmic substances). In 1871 I had announced, that, besides the hydrogen lines, I had established in the spectrum of the corona the presence of the *D* line and of several others.

“In the present eclipse I proposed especially to solve this question. By means of the optical arrangements above described, I have been able to determine that the basis of the coronal spectrum is composed of the complete Fraunhofer spectrum. The principal lines of the solar spectrum, especially *D*, *b*, *E*, etc., were detected so surely that there can be no possible doubt of this fact. I recognized, perhaps, a hundred lines.

“I recognized this composition of the spectrum, particularly in the lower or most brilliant portions of the corona, but not to an equal degree at the same distance from the moon’s limb. The details of this will be given and discussed at a future time.

“I studied also the rings of Respighi. The rings did not appear uniform about the moon’s limb, but presented peculiarities of structure which will be especially discussed in their relation to the question of the Fraunhofer lines.

“I studied also polarization, but devoted to it only a few moments, using the excellent biquartz polariscope of Prazmowski. The polarization was very well defined, and possessed characteristics already recognized.

“Before the observations, I made a preliminary examination of the corona with the naked eye, and with an excellent telescope by Prazmowski. This examination was for the purpose of guiding me in the subsequent observations.

“All these studies—study of the shape, spectrum analysis, Respighi’s rings, polarization—were combined with the view of solving the question of extra-solar cosmic substances. We think that the discovery of the complete Fraunhofer spectrum in that of the corona considerably advances this question.

“*Photography.*—Two great instruments, containing eight cameras, had been prepared for studying the question of intra-mercurial planets, and that of the shape and extension of the corona. With regard to heavenly bodies in the vicinity of the sun, these photographs will require a minute examination; but, with respect to the corona, it can be said that the great power of several of the lenses used [that of eight inches (0.21 m.) and that of six inches (0.16 m.)], and

also the length of exposure, permitted us to prove that the corona has an extension very much greater than that shown by optical examination, either with the naked eye or in my telescope.

“Several of our large photographs of the corona have great distinctness. They show important details of structure which ought to be discussed. The shape of the corona was absolutely fixed during the whole duration of totality.”

The reports of Messrs. Tacchini, Palisa, and Trouvelot are not given, but are alluded to in the discussion of the results of the observations, which next follows. Mr. Janssen regards it quite improbable that any intra-mercurial planets exist, on account of the negative testimony given by Mr. Palisa, combined with that of Professor Holden of the American party. Mr. Trouvelot’s conclusion is less decisive, but the observer wished to re-examine the region of the sky before coming to a final conclusion.¹ The author adds, “When we consider that the bodies discovered by Professor Watson in 1878 can be identified, within the limits of error to which the method employed by that astronomer is liable, with two stars in Cancer,² we arrive at the conclusion that it is to-day extremely improbable that there exists one or more planetary bodies of any importance between Mercury and the sun. Our photographs, although not yet completely examined, seem to lead to the same conclusion.”

The duration of totality was found by Mr. Trouvelot to be 5^m 24^s.1, by Mr. Tacchini to be 5^m 23^s.

On the subject of the corona, Mr. Janssen thus writes:—

“*The corona.*—Mr. Tacchini’s report shows that this skilful astronomer made remarkable observations at Caroline Island, especially with regard to the analogy between the composition of the spectrum of certain parts of the corona and the spectrum of comets. It was part of my plan to examine this correspondence, as is shown by a note drawn up by me long before the eclipse, and which I read to my colleagues when we compared our respective reports. It is a matter which ought to be verified with the greatest care in future eclipses. However, I leave to Mr. Tacchini the task of developing his observations.

“It will be seen from my report, that the principal object of my observations was to decide one point of the composition of the spectrum of the corona which

¹ Mr. Trouvelot observed, near the close of totality, a star which he describes as ‘bright, and of a pronounced red color;’ but, by some misunderstanding, its position was not recorded by the special attachments to the circles above described. Its position, therefore, cannot be determined, nor the question of its identification be positively settled. The observer announces (*Comptes rendus*, Sept. 17) that he has re-examined the region, and finds no star of the corresponding magnitude and color in the vicinity of the approximate position which he was able to assign to it. “Although,” he adds, “the absence of a red star as bright as that which I observed in the eclipse seems quite naturally to lead to the conclusion that the body in question is no other than an intra-mercurial planet, yet as the most necessary elements, such as the position and a disk or a sensible phase, are wanting in my observation, I think I ought to suspend, for the present, my conclusions upon the probable nature of the body.”

² First pointed out by Dr. C. H. F. Peters (*Astron. nachr.*, nos. 2253 and 2254).

has always seemed to me very important; viz., whether the light of the corona contains an important proportion of solar light. The result surpassed my expectation in this matter. The Fraunhofer spectrum, so complete as I witnessed it at Caroline Island, proves, that, without denying that a certain part is due to diffraction, there exists in the corona, and especially in certain parts of the corona, an enormous quantity of reflected light; and as we know, besides, that the coronal atmosphere is very thin, it must be that in these regions cosmic matter exists in the condition of solid corpuscles, in order to explain this abundance of reflected solar light.

"The more we advance, the more we perceive the complex nature of the regions in the immediate vicinity of the sun; and it is only by persistent and very varied observations, and an exhaustive discussion of these observations, that we can arrive at an exact knowledge of these regions. The great eclipse of 1883 has allowed us to take a step forward.

"*Photography of the corona.*—The result of the studies of the photographs will be given later; for they require a thorough examination, since they record many most interesting phenomena. I will simply say at present, that these photographs show a corona more extended than that given by telescopic examination, and that the phenomenon appeared well defined and steady during the duration of totality.

"*Luminous intensity of the corona.*—I had prepared a photometric measure, by photography, of the luminous intensity of the corona. This experiment showed that at Caroline Island the illumination given by the corona was greater than that of the full moon. The exact numbers will be given later. It should be noted, that this is the first time that an exact measure of the luminous intensity of this phenomenon has been made."

The remainder of the report gives an account of the return journey of the members of the expedition. They visited the volcano of Kilauea on the island of Hawaii, and passed a night in the crater on the edge of the lava lake. Mr. Janssen made some experiments, which, he states, "show some curious coincidences between these volcanic phenomena and those of the solar surface. I was able, also, to obtain the spectrum of the flames which issue from the lava, and to establish in them the presence of sodium, hydrogen, and the carburetted compounds."

W. U.

THE HIMALAYAS.¹

My predecessor, Sir Richard Temple, selected for the subject of his address to this section last year, 'The central plateau of Asia.' Following him in a measure over some of the same ground, I have selected the mountain region south of the Central Asian highlands, viz., the Himalayas, and more particularly the western portion of that range, as the subject of this paper. I propose considering this

mountain chain with reference to its physical features, past and present, and consequently with reference to its geological history, so far as that relates to later tertiary times; i.e., the period immediately preceding the present distribution of seas, land, rivers, and lakes. It is not, however, my intention to enter very deeply into the purely geological branch of the subject.

The Himalayas, the highest mountains in the world, comprise, strictly speaking, only the snowy range seen from the plains of India, bordering upon the course of the Ganges; but we might, I think, use the term in an extended sense, so as to include that which we may call the north-western Himalaya, north of the Punjab, and also the eastern Himalaya, bordering on Assam. The orography of this mountain mass has been recently ably handled by Messrs. Medlicott and Blanford;¹ and I follow them in all their main divisions and nomenclature, which are based upon a thorough understanding of the rocks of the country. Some line must be selected where the term 'Himalaya' must cease to be used, and this cannot be better defined than by the valley of the Indus from Attock to Bunji. On this line we find the great bending-round of all the ranges. To the mountains north of the Indus, on its east and west course, the name 'Himalaya' should certainly never be applied. For this north-west, trans-Indus part of the Asian chain we have the well-known name 'Mustagh,' so far as the head of the Gilgit valley; the 'Hindu Kush' being an excellent term now in common use for its extension to the Afghan country.

The observations made by many of the assistants of the Indian geological survey, more especially by Stoliczka, and more recently by Lydekker, in the Himalayas, combined with those made by myself in the same region, have, when considered in conjunction with the ascertained strike of the granitoid or gneissic rocks, led me to separate the great Central Asian chain into the following five principal divisions, with some minor subdivisions:—

- | | |
|---|-----------------------------|
| 1. The main or Central Asian axis, Kuenlun. | 4. Outer or lower Himalaya. |
| 2. Trans-Himalaya. | 5. Sub-Himalaya. |
| 3. Himalaya. | |

In our present ignorance as to the composition of the chain eastward from the Sutlej, we cannot attempt to lay down there any axis-lines of original elevation; but the separation of the line of highest peaks into one range, and the water-parting into another, is an acceptable solution of the physical features, as at present known, of this part of the chain. I think, however, that when this ground is examined, it will resolve itself into a series of parallel ridges, more or less close, and oblique to the line of greatest altitude as defined by the line of high peaks, crossing diagonally even the main drainage-line of the Sanspu; just as we see the Ladak axis crossing the Indus near Hanlé, or the Pir Panjal that of the Jhelum. Sir Henry Strachey's conception of the general structure was the soundest and most scientific first propounded.

¹ A manual of the geology of India, 1879, p. 9.

¹ Abstract of an address by Lieut.-Col. H. H. GODWIN-AUSTEN, F.R.S., F.G.S., F.R.G.S., etc., president of the section of geography of the British association.

He considered it to be made up of a series of parallel ranges running in an oblique line to the general direction of the whole mass, the great peaks being on terminal butt-ends of the successive parallel ranges; the watershed following the lowest parts of the ridges, and the drainage crossing the highest, in deep gorges directly transverse to the main lines of elevation.

We can, in a measure, exemplify the structure of the Himalaya by that of the bones of the right hand, with fingers much elongated and stretched wide apart, of which the wrist and back may represent the broader belt of granitic rocks of the eastern area; the thumb and fingers, the more or less continuous ridges of the north-west, some less prolonged than others to the north-west, such as the Chor axis, which may be represented by the thumb, terminating on the southern margin near the Sutlej. The left hand placed opposite will represent the same features to the west of the Indus. We will even carry this simile farther, and, as a rough illustration, suppose the intervals or long basins between the fingers to be filled with sedimentary deposits, and the fingers then to be brought closer together, producing a crushing and crumpling of the strata. At the same time, an elevation or depression, first of one or more of the fingers, then of another or of the whole hand, has taken place, and you are presented with very much what has gone on, upon a grand scale, over this vast area. As these changes of level have not taken place along the whole range from east to west in an equal extent, but upon certain transverse or diagonal lines, undulations more or less great have been the result; and some formations have attained a higher position in some places than in others, producing, very early in the history of these mountains, a transverse system of drainage-lines, leading through the long axial ridges.

The last efforts of these rising, sinking, and lateral crushing, and, as I believe, very slowly acting forces, are to be seen at the southern face of these mountains, in the tertiary strata that make up the sub-Himalayan axis (Sivalik), — a topographical feature which is most striking by reason of its persistence and uniformity for some 1,600 miles. From Assam on the east, to the Punjab on the west, bending round and extending to Scinde, this fringing line of parallel ridges is found at the base of the Himalayas, sometimes higher, sometimes wider, often forming elliptical valleys. Only in one part of the belt, east of the Teesta, are they absent altogether for a distance of fifty miles. These formations are of vast thickness, and, in the Punjab, cover an area of 13,000 square miles. The whole of this material has been derived from the adjacent Himalayas, and has travelled down valleys that have been excavated in pre-tertiary times. This points to a slow subsidence of the whole southern side of the mountain mass, deposition generally keeping pace with it, broken off by recurring long intervals of re-elevation.

The next most interesting feature connected with the former distribution of land and sea is that these sub-Himalayan formations are fresh-water, or torrential, showing that since nummulitic or eocene

times the sea has never washed the base of the Himalayas. In fact, there is no evidence of this from the gorge where the Ganges leaves the mountains up to the base of the Garo Hills. I believe that from Assam to Scinde there once existed a great river, receiving its tributaries from the Himalayas, partly a land of lakes and marshes, the home of that wonderful mammalian and reptilian fauna which Cautley and Falconer were the first to bring to light. The southern boundary of this long alluvial plain was formed by the present peninsula of India, and probably of the extension of the Garo and Khasi Hills westward to the Rajmahal Hills. Depression has been considerable in the neighborhood of Calcutta, nearly five hundred feet. At three hundred and eighty feet, beds of peat were passed through in boring; and the lowest beds contained fresh-water shells. The beds, also, were of such a gravelly nature as to indicate the neighborhood of hills, now buried beneath the Ganges alluvium. This is precisely the appearance of the country above Calcutta, on approaching the present valley of the Brahmaputra. The western termination of the Garo Hills sinks into these later alluvial deposits; and along the southern face of the range, up to Sylhet, the waters of the marshes during the rainy season wash the nummulitic rocks like an inland sea, and point to the very recent depression of all this area. The isolated granite hilltops jutting up out of the marshy country from Dhoobri to Gwalpara, and on to Tezpur, all testify to the same continuous depression here. It is exactly north of this that we find the Sivalik formations, absent at the base of the Himalayas.

This gradual depression of the delta of the Ganges, the relative higher level of the water parting and shifting of the Punjab rivers westward, appear to be only the last phase of that post-pliocene disturbance which broke up the Assam sub-Himalayan lacustrine system draining into the Arabian Sea. Zoölogical evidence, which I cannot here find space to quote, is also in favor of this former connection of the now separated waters of the Ganges and Indus basins, and the hill-tracts of the Garo and Khasi Hills with peninsular India.

Within the mountains in the old rock basins — and these are analogous to the valleys of the Alps — are pliocene and post-pliocene beds of great thickness, but of fresh-water origin; the remnants of which are to be seen in Kashmir and Scardo at intervals, along the valley of the Indus, and that large, now elevated, accumulation at the head of the Sutlej River in Hundes, — all in the more sheltered portions of the valley basins, untouched by the denuding action during the glacial period. The extent and displacement of the upper pliocene beds in north Italy and here are very similar. Often abutting horizontally against the mountains, they are in other places found tilted at considerable angles on the margin of their original extension. When we examine their contents, we find that the fauna of that time, in Asia as well as Europe, was more African in character, and included the hippopotamus, crocodiles, and tortoises; of which, the common crocodile, the gavia or long-snouted species, and an Emys,

have survived the many geological changes, and still inhabit the rivers and low grounds of India to-day. The fresh-water shells are the same now as then. Many species of antelope lived in the neighboring plains and uplands. The elephant was there in the zenith of its existence, for no less than thirteen species have been found fossil in northern India.

If we now turn to Europe to compare formations of similar age, Lombardy and the valley of the Po, with the southern side of the Alps, present to us somewhat similar physical features. A large area of about the size of the north-west Punjab, once a part of the miocene sea, is occupied by a remnant of rocks of that age, considerably elevated and tilted, but not to such an extent as those of the Himalayas. Near Turin these dip towards the mountains; and a very short examination shows the undoubted glacial character of some of the beds; and, as the whole formation is marine, their large sharply angular material, much of which is jurassic limestone, was probably transported from the adjacent mountains by the agency of ice in a narrow sea.¹ After the great crushing and alteration of the previous outlines of the whole country, another sea filled the basin of the Po, and pliocene deposits were laid down in a sinking area extending to the base of the mountains all round the new bay or gulf. Re-elevation again set in, and with it, or soon after it, the advent of another and the last glacial period.

Before the last great elevation of the alpine chain, the whole line of seacoast, therefore, ran even high up the long deep valleys of Maggiore, Como, Garda, etc. Then came the gradual but uneven elevation of the whole area, including the miocene hills south of the Po; and lacustrine and estuary conditions prevailed over much of the plain country. The lapse of time was probably enormous; and, as the land rose and the sea retired, the climate gradually became cooler, and ushered in the glacial period. With the change and the increased volume of the mountain torrents, the destruction of the upraised marine pliocene beds commenced, and finally culminated in the extreme extension of the glaciers, even into the plains. The denudation of this formation has been enormous along the base of the Alps, and only mere remnants are to be found. Their preservation is due to their being in position where the great denuding force, the ice, has been unable to touch them: in other instances the early deposition of moraine matter upon them has acted like a shield, and prevented their entire destruction.

The scattered remnants of the pliocene formation south of the Alps show well how soon a great formation may be completely destroyed by denuding forces.

¹ No trace has been observed of this glacial period in the miocene of India. The most lofty portions of the chain had not then attained a greater elevation, probably, than 14,000 to 18,000 feet, and the outer axis-lines far less. However, in the tertiary beds (middle eocene?) of the Indus valley, below Leh, such conditions are indicated by Lydekker (*Memoirs of geological survey of India*, vol. xxii. p. 104, which I have received since this address was sent to press).

It is an established fact, that the great valleys of the Alps and Himalaya existed much in their present form during miocene times; and they may owe their excavation partly to the glacial action of that period, when these mountain slopes rose from the plain or margin of the ancient sea, far in front of the present line of slope, and were far higher than now.

It is not improbable, that, during the earlier extension of the glaciers into the Maggiore basin, the sea still had access to it. This would have greatly aided in the removal of the marine deposits, and then the deeper erosion of its bed near the Borromean Islands, so well put forward by Sir Andrew Ramsay. When we see the gigantic scouring which glaciers have effected in the hardest rocks on the sides and bottoms of valleys, when we know for certain the enormous thickness they reached in the Alps, I do not doubt for a moment their capability of deepening a rock basin very considerably, or their power to move forward over and against slopes so low as 2° to 3° .¹

Passing from the glacial action displayed in the outer Alps to that in the Himalaya, we find ample evidence of a period of great extension of such conditions, first in the erratics of the Attock plain and the Potwar, lying fifty to sixty miles from the gorge of the Indus at Torbela. We have again the fact that in Baltistan, in the Indus valley, glaciers have twice descended far beyond their present limits, first down to Scardo itself, and then to some thirty miles below their present limits; while the glaciers of Nanga Purbet, towering above the Indus some 22,000 feet, must have descended into the bed of that river.

In fact, examples of the former extension of glaciers are wide-spread along the chain of the Himalayas from west to east. True moraines and moraine-mounds, at 16,000 feet on the north side of the Baralasa Pass, attest the presence of glaciers on the elevated plain of Rukshu, where now the snow-line is over 20,000 feet. Drew gives much valuable information regarding their former size. On the east, in Sikkim, Sir Joseph Hooker has described moraines of great height (700 feet) and extent. Still farther south and east, in the Naga Hills, a short period of greater cold is indicated by the moraine detritus under the loftiest portion of the Burrell range, in latitude $25^{\circ} 30'$.

Whatever may have been the length of the glacial period in the Alps,—and it was very considerable,—in the Himalayas it cannot have been so long and so general, although to a certain extent contemporaneous.

In the Alps, glaciation meets the eye on every side; and the mountains, up to a distinct level, owe their form and outline to its great and universal extension. In the Himalayas it is difficult to trace polished surfaces or striae markings, even in the neighborhood of the largest glaciers that are now advancing in

¹ There appears to be too great an advocacy, on the one hand, of ice-action having done all the work of denudation; while, on the other, some writers consider this to have been extremely limited. It is the combination of the two forces, I think, that effects so much, and in so different a manner and degree.

full activity. Although of such great length, these Himalayan glaciers could never have reached the enormous thickness which the earlier alpine glaciers attained.

Two periods of glacial extension are clearly defined, separated by a milder interval of climate. During the earlier glacial period the Indus valley was filled with those extensive lacustrine and fluvial deposits, mixed with large angular *débris*, such as we see at Scardo, which may be coeval with the extreme extension of the alpine erratics, so far as the miocene hills south of Turin.

The second period followed after a long interval of denudation of the same beds, and would correspond with the last extension of the great moraines of Ivrea, Maggiore, Como, etc., followed by a final retreat to nearly present smaller dimensions. Nowhere on the south of the Himalaya do we find valleys presenting any features similar to those of the southern Alps, particularly on the Italian lakes, which are, I believe, the result, in the first place, of marine denudation, succeeded by that of depression, and finally powerful ice-action.

This attempt to bring before you some of the great changes in the geography of Europe and Asia must now be brought to an end. I am only sorry it is not in more able hands than mine to treat it in the manner it deserves, and in better and more eloquent language; but it is a talent given to but few men (sometimes to a Lyell or a Darwin) to explain clearly and in an interesting form the great and gradual changes the surface of the earth has passed through. The study of those changes must create in our minds humble admiration of the great Creator's sublime work, and it is in such a spirit that I now submit for your consideration the subject of this address.

FRENCH GEOGRAPHICAL EXPLORATIONS.¹

SINCE the last re-union of our societies, we have seen the complete success of the French expedition to observe the transit of Venus. This phenomenon, important for astronomy, which requires a unity of measurement of the celestial spaces, should also be of interest to geography, for the unity sought is the correct distance of the sun from the earth. We already know the distance of the moon from the earth, about ninety-six thousand leagues, of which I can easily form an idea, as it is the distance I have traversed by land and sea since 1854, the time that I commenced my isthmus travels. "The French expedition sent to foreign parts to observe the transit of Venus has obtained a great and well-earned success, of which they are justly entitled to be proud." So says one of the most eminent French *savants*, Mr. Dumas, who has largely contributed to that success.

It now remains, and it is not the least difficult part of the task, to compare the results obtained, in order to submit to a delicate analysis the infinitesimal differences, which correspond to errors of hundreds

¹ Address by FERDINAND DE LESSEPS before the geographical congress at Douai. Translated from *Cosmos-les-mondes*, vi, 91, 121.

of kilometres, in the distance sought. *Savants* have, it is true, more than a century to make use of the observations of 1882; for the phenomenon will not take place again till the year 2004.

At the extreme east of Europe we find in process of execution a work whereby modern science shall again assert her superiority by a success which the ancients gave up. Through the initiative of Gen. Türr, the Isthmus of Corinth is at this moment being cut, which will shorten by about two hundred and fifty kilometres, on an average, the voyage between the eastern and western parts of the north of the Mediterranean. In the course of the present year, the two plains at the side of the Gulf of Aegina and the Bay of Corinth will be cut away, and workmen will attack the solid mass of forty-seven metres, which it is desired to cut away to eight metres below the level of the sea. It is, *in minimo*, the cut of the Isthmus of Panama, the length of which is seventy-three kilometres instead of six kilometres; that is, double the distance between the garden of the Tuilleries and the Arc de Triomphe in the Étoile at Paris.

Some distance north of Corinth, there is unfolding another episode of the struggle between these two rival powers, the earth and man. There the work has begun which will transform a marshy lake into fertile plains. In a few years, broad Lake Copais will suffer the fate of Lake Fucino, Lake Fessara, Lake de Harlem, and the marsh of Pinsk.

There is still a fourth isthmus to cut. The king of Siam has authorized a survey for a maritime canal on his territory, between the Indian Ocean and the seas of China and Cochinchina. The object is to escape the dangerous Strait of Malacca, and gain six hundred leagues from Europe to the extreme east.

In Arabia, Mr. Charles Huber, who two years ago successfully accomplished a mission for the minister of public instruction, has resumed the journey he made so fortunately; but he wishes to proceed farther than at that time he was able. At present he is at Palmyra, copying rare inscriptions; and, this completed, he will set out for Hall, for the Nedjed, and perhaps farther if circumstances favor his energy and firm will. The Arabian peninsula is one of the fields of study where French science has a long standing and very honorable record. We can but hope that Mr. Huber may show himself worthy of his predecessors.

In the extreme east, Cochinchina and Tonquin have been most recently explored by the French, and I should like to recount the discoveries of Dr. Néis and Lieut. Saptans at the sources of the Donnai. The former is at present *en route* for the region which he has already visited. Ethnography and anthropology, which are his special objects of study, will no doubt acquire new information, full and exact, from Dr. Néis's present journey. The study of the ancient civilizations and of epigraphy engages the attention of Capt. Aymonier, who has just finished a fruitful exploration at Cambodia. The parcels recently sent to the museum of the Trocadero testify to the importance of the results gathered by Mr. Aymonier, who is one of the most distinguished, perhaps the most distinguished, representatives of Indo-Chinese

students. Tonquin is known to us only by its delta, which has been an object for fine work by French hydrographic engineers. Beyond, to the right and left of the Red River, surveyed first by Mr. Dupuis, and afterward by Mr. de Kergaradec, we know nothing, or almost nothing, with certainty. Last year, in the face of dangers to which his companion Mr. Courtin succumbed, Mr. Villeroi-d'Augis made an examination which has given us the first rough sketch of the course of the Black River. The mineral resources of Tonquin, on the coast at least, have been ascertained by Mr. Fuchs in a recent voyage; and this distinguished engineer seized the opportunity to gather the first materials of the geological constitution of that part of Anam, as well as the rest of Indo-China. The events which are taking place at Tonquin we cannot examine; but they will lead, doubtless, to a state of things which will render journeys practicable. Mr. Harmand, who was conspicuous at the beginning of his career for his important explorations, will doubtless lend his co-operation to the French explorers who are about to set out for these parts of Asia.

If we turn our eyes toward Africa, we see several Frenchmen engaged in the contest which will definitely free this continent to science in opening it to civilization. For all Algeria the time of exploration, properly so called, is past. The country surveyed by geodesians is open to military topographers, who will give us a representation of it as beautiful and as correct as the map of France. At the instigation of our colleague, Col. Perrier, chief of the geographical service of the army, the surveys are being followed up, and the publication of the work will soon begin, to be continued without interruption.

For the extreme south of Orange, geography had only a series of isolated guide-books, with a few descriptions carefully made, but limited. Wars have drawn to this territory a troop of surveyors, whose campaigns have resulted in a survey, based on a triangulation, of all the country between Mecheria, the terminus of the Orange railroad, and the great oasis of Figuig. I certainly do not err in asserting, that the officers who have accomplished this difficult and dangerous work, Capt. de Castries and Lieuts. Brosselad and Delcroix, deserve well of geography.

In France the events in Tunis have been watched with much interest. Geography will gather the first fruits from these events. Here, again, we were reduced to information confined to the surroundings of Tunis, and certain points of the regency, and very estimable itineraries, but whose loose threads circumscribe vast regions left blank on the charts or timorously sketched. Following our exploring column, skillful surveyors have continued to fill up these gaps. Their records have been completed, and arranged methodically by officers attached to the geographical service of the army. If I am correctly informed, this service now possesses the materials for a large map, on which Tunis will appear in a decidedly new light, with the arrangement of its valleys, the character and projection of its prominence, and the precise position of its centres of population.

The minister of public instruction, on his part, has organized an expedition for the scientific exploration of Tunis. Already, from an archeological standpoint, important discoveries have been made on this ground, where exist the relics of several great civilizations. The learned work of Mr. Charles Tissot, the correspondent of the institute, formerly ambassador to London, will be, as far as concerns the Roman epoch, a fine and substantial introduction to the investigations undertaken. Our protectorate will revive the Tunis of the past, while it creates a Tunis of the future. Here is the opportunity to mention the scheme in regard to the interior African sea, rendered practicable by the perseverance, disinterestedness, and knowledge of Commander Roudaire. Other surveys, executed during this campaign by the engineers whom Capt. Henry leads, fill up the gaps in the previous works, complete the information regarding the banks of the Senegal or its tributaries, and prepare the route towards Bammakoo for the next expedition. This time a larger party must be sent out than on preceding expeditions, and they ought to advance farther. After having, while the road was making, removed, without striking a blow, the chief of Moorgoola, who was hostile to us, and after taking by assault the village of Daba, where advance was opposed, the column finally arrived at Bammakoo, Feb. 1; and, on the 7th, Col. Borgnis-Desbordes laid the first stone of the fort. From this first journey, under the direction of Capt. Bonnier, the surveyors, who included some experienced officers (Capt. Vallière, for instance), have brought back very complete results, extending over the ground between Kita and Bammakoo, and in the surrounding countries, Fooladoogo, Gangara, and Bélédoogoo. They have also contributed largely to the geography of a country lately only touched by a few explorers.

I do not know that you will agree with me; but I see, in these three expeditions of Col. Borgnis-Desbordes, a very interesting moral side. Let us imagine a handful of men setting out from Calais, to reach, in a certain time, the neighborhood of Vienna or Budapest: let that be the distance. You know the difficulties that were encountered. After a long journey in barges on the Senegal, it was necessary, under a burning sky, to make weary marches across districts covered with high grass or with thorny plants, and across calcined plains. They must scale steep acclivities, pass through innumerable swamps, slimy and malarious. They must venture through narrow paths on the sides of cliffs into defiles, — veritable Thermopylae, where a few might stop an army. After the departure, fever attacked the column, and each day claimed its victim. Nevertheless their courage did not fail. At times they were compelled to fight, and to the ravages of fever was added the fire of an enemy who could not be disregarded. Sometimes they stopped; but then they were obliged to work without relaxation in building a fort, for the season was advancing. Three times in succession our soldiers, under such circumstances, have penetrated to the heart of the western Soodan, led by a man hardened by bravery. He was commissioned to push to

the Niger the line of stations which should establish our claims. He advanced straight to his object: the difficulties of detail discouraged him no more than the unforeseen disconcerted him, or than danger frightened him. Thus supported by officers worthy of their leader, and by soldiers full of devotion, he has accomplished his whole task. The little phalanx re-embarked on the Senegal, ragged, worn out, emaciated, and reduced more than a third; but they had nobly and simply performed a grand deed.

Before leaving the Senegal, I would not forget to mention the efforts of Dr. Bayol to contribute to the geographical knowledge of these countries. You may already see, on the map of Africa, very carefully prepared by Capt. Lannoix for the geographical service of the army, the line of travel which, in his preceding journey, Dr. Bayol followed between Timbo and Medina, in a country still unknown. At present he has just traversed more than three hundred and sixty kilometres in a country, also left blank, or nearly so, on the maps. Lieut. Quiquandon, his companion, gives us a survey of the line of march, which, retreating from the Niger, will join the line of march of the Austrian traveller, Lenz, on his return from Timbuctoo. This is an important paper for geography. Mr. Bayol has arranged so that, up to Ségala, the states through which he has passed have accepted the protectorate of France. Besides the treaties to this effect, he brings back collections which will contribute largely to the geological and zoölogical description of this zone of the African continent.

If, now, we turn farther south, as it were symmetrically with the Senegal and the Niger, we shall come to the Ogowé and the Kongo. Here, too, we find a man firmly resolved to secure for France a country worthy of her on the banks of the Kongo. Here Mr. de Brazza (for you all have recognized to whom I refer) is at work. As I speak to you now, he must be *en route* for the great river, the inhabitants of whose banks will, without doubt, gladly welcome back an explorer who was always full of justice and humanity toward them. It is said that difficulties exist between Mr. de Brazza and Mr. Stanley. The situation has, I think, been much exaggerated. Let us not forget that the origin of the enterprise to which Mr. Stanley devotes his energy is due to his Majesty the king of Belgium, and was formed for the purpose of sparing the travellers of all nations a part of the dangers of their enterprises. The generous founder of the International African association will certainly do all in his power to establish kindly relations between two of the most illustrious pioneers of civilization and of science. Besides, Mr. de Brazza would not falsify by his acts the words which he uttered at the last banquet of the Société de géographie, when he received from the hands of his fellow-explorers the French colors: "There, where I shall be commissioned," he said, "to carry the colors you present to me, they will be a sign of peace, of liberty, of science, and of commerce; they will be kind and compassionate with the weak and courteous, but firm with the strong." Let us, then, be patient. Let us not expect, that, under the present circum-

stances in equatorial Africa, evolution and progress can be very rapid. Let us also not forget that we owe all respect to the claims of our friends the Portuguese to certain regions bordering the Kongo.

I would not neglect to invoke your sympathies for the calm courage with which, in western Africa, on the route of the great lakes, Mr. Bloyet accomplished the mission placed upon him by the French committee of the International association. The travellers of several nations could tell us what protection they have received, what support, what counsels, they have obtained, from Mr. Bloyet. It is his courage which assists in the noble task of making the French name loved and respected by the natives of these hostilely inclined countries. Still nearer the lakes are our Catholic missionaries, some of whom have already given to geography useful data of the countries in which they are engaged. The same is being done, also, by French evangelical missionaries farther south, in the region of the Lessooto. One of them, Mr. Kurger, is busily at work, perfecting a map of the country. We hear little from Mr. Victor Giraud, who is proceeding in the direction of the great Lake Banguelo, south of which Livingstone died. Our best wishes accompany the young explorer, whose character, knowledge, and equipment warrant us in expecting much of him.

Before leaving Africa, I wish to mention one who has already proved himself a distinguished traveller. I refer to Mr. Georges Rexoil. He is engaged at the south in the large peninsula of the Comalis, which he has explored at the north with so great success. If he succeeds in penetrating into this unknown and formidable region, he will certainly garner a new scientific harvest not less rich than the preceding.

Allow me to approach America, and briefly speak to you of the cutting of the American isthmus between Colon and Panama. Two years have been spent in preparing the field of battle. The entire line is occupied by our workmen and machines. The director, Mr. Dingler, engineer-in-chief, who has just set to work our corps, has returned to Paris to report both his plans and his preparations to inaugurate the canal in 1888. In the course of this year, till July of the year following, he will each month remove from the cut a million cubic metres of *débris*, and from that date two million cubic metres a month, making twenty-four million a year. The enterprise will be finished during the following four years. I intend to visit this magnificent work early in 1884, and I hope that delegates from our geographical societies will accompany me. I must not leave Central America without respectfully referring to the successful perseverance with which one of the most devoted missionaries sent out by the minister of public instruction, Mr. Désiré Charnay, has explored the ruins of Yucatan. His researches and discoveries, together with his inferences, certainly throw unexpected light on the former obscurity of the American civilizations.

The feeling of sadness which we all experienced, on learning the terrible ending of the expedition of Dr. Crevaux, is still with us. Since then, only vague rumors have reached Europe in regard to this

tragedy in the heart of South America. Mr. Thouar, a young French traveller, is now facing dangers of every description, in his attempt to discover the remains of our unfortunate countrymen. Gathering information, and supported by good will on all sides, he is making slow but regular advance. We can only hope that he will attain his object; while we do not ignore the dangers to which he so generously exposes himself in trying to penetrate, accompanied only by an interpreter, a country inhabited by Indians who overthrew the mission of Dr. Crevaux. Our warmest hopes for success go with him in his noble undertaking.

At the extreme south of America, at Tierra del Fuego, a French mission, established a year ago, has been commissioned, in accordance with the international programme, to make meteorological and magnetic observations. We look forward to the next return of the guard-ships, whose work, accomplished under the direction of Mr. Martial, commander of the *Romanche*, will form a valuable contribution to the physical geography of these parts.

Finally, after a successful expedition to the northern latitudes, in the polar seas, which, since the voyage of the *Recherche*, have scarcely seen the French flag, one of our countrymen, Mr. Charles Rabot, is at present continuing in Russian Lapland the investigations which he began in Sweden. The region which he includes still offers a vast field for geographical and geological study.

Such, my dear colleagues, are the chief means by which the advance of French geography, in its most active and most persistent form is disclosed. I might still speak to you at length, but we must not deserve the reproach of weaving for ourselves crowns; and, in the noble titles I have just recalled to you, we should see rather the obligations they place upon us than the satisfaction which they bring to our proper national pride.

LETTERS TO THE EDITOR.

Marriage laws of the Omahas and cognate tribes.

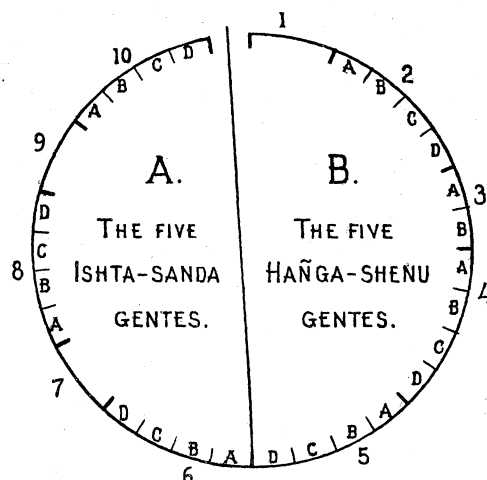
THE Dakotas or Sioux still have mother-right in some of their tribes, and I cannot say how far the following statements apply to them; but the Omahas, Ponkas, Kansas, Osages, and others have father-right, and are governed by the principles here given, with one exception, — the Kansas have recently disregarded their laws, and have begun to marry in the gens.

The Omaha tribe is divided into ten gentes or clans, each gens having its special place in the tribal circle. In the figure the numerals denote the gentes, and the letters the sub-gentes.

Suppose that I belong to 1, the Elk gens, which is also my father's gens: I cannot marry any female of that gens. If my mother belongs to 2, a buffalo gens, I cannot marry any woman of that gens.

Suppose that my father's mother belonged to 3 a, my mother's mother to 4 a, my father's father's mother to 5 a, my mother's father's mother to 6 a, my father's mother's mother to 7, and my mother's mother's mother to 8 a: I cannot marry any women of 3 a, 4 a, 5 a, 6 a, 7, or 8 a, if I know of their re-

lationship to me; but I can marry any women of the other sub-gentes, 3 b, 3 c, 3 d, 4 b, 4 c, 4 d, 5 b, 5 c, 5 d, 6 b, 6 c, 6 d, 8 b, 8 c, or 8 d, as they are not my full kindred.



I can also marry any women of 9 or 10, if they are not forbidden to me for other reasons; that is, if they are not my affinities, such as the wives (*real or possible*) of those whom I call my fathers, mother's brothers, grandfathers, sons, sister's sons, or grandsons.

Principles considered. — 1. Marriage in the father's gens forbidden. 2. Marriage in the mother's gens forbidden. 3. The regulation of the sub-gens. 4. Potential or possible marriages must always be kept in mind, and kinship terms are based upon them.

J. OWEN DORSEY.

Washington, D.C.

Francis Galton's proposed 'Family registers.'

Mr. Francis Galton is now planning to push his inquiries into the laws of heredity upon a more extensive and systematic scale than ever before. The success of his early work, 'Hereditary genius,' led him to observations in a wider field, which extended over several years, and were collected in his very valuable book, 'Inquiries into the human faculty,' which appeared last spring. His new proposal involves the collection of a large number of family biological histories, to extend over three or four generations, and to be obtained by circulating an exhaustive schedule of printed questions. The writer has just received a copy of the latter, together with a prospectus of the general plan, which Mr. Galton will call 'Family registers.' The revised schedules will shortly be ready for distribution. In the mean time an abstract of the prospectus and schedule may be given.

Mr. Galton foresees the difficulties which he will encounter; and, appreciating that the obtaining of accurate family histories of health and disease among laymen is almost out of the question, his prospectus appeals principally to the medical profession. Among doctors, all inherited disease is a disease, and not necessarily an hereditary disgrace, as most of the laity are apt to regard it. In this class, also, the scientific interest attached to inherited imperfections of physique or mind often overbears every other feeling. At all events, although the *anonymous* will be strictly maintained, Mr. Galton seems to expect that few non-professional persons will be ready even

to put upon paper the rather searching register of replies.

The narrowest scope of inquiry, to be of any value, must embrace three generations; but the results will be far more reliable when they cover four. The latter would relate to at least thirty-six persons, which Mr. Galton reckons as follows: "On the side of the contributor there are his two parents, four grand-parents, an average of three uncles and aunts on each of the two sides, three brothers or sisters, and himself; this makes sixteen persons. There is another set of sixteen for the relatives of his wife in the same degrees. Lastly, I allow an average of four children." A single family register of this size, therefore, at least involves the filling-out of nearly thirty-six of the schedules, which will be no light task, even with the most favorable opportunities of obtaining information. The persons whom Mr. Galton anticipates will assist him the most are young physicians, married and with children. In case the grand-parents are living, their field of information will naturally be very wide. Partly as an inducement to men of this class to undertake such a task, partly as a pecuniary return for the time which it must necessarily occupy, a series of prizes will be offered, amounting, altogether, to £500, including, probably, ten prizes of £25 each, and others not to exceed £50 nor fall short of £5. The returns are to be sent with mottoes, but no signature; the name and address to be enclosed in a separate envelope bearing the motto. The merit of the returns will be estimated by the clearness and exhaustiveness of statement, the number of generations treated of, and the appendix (see beyond).

The returns asked for are in abstract as follows:

1. A separate and full biological history of each member of the family in the direct line of ascent;
2. A very brief statement of the main biological facts in the lives of members of the collateral lines of ascent, that is, of the uncles and aunts, great-uncles and great-aunts, etc.;
3. A full description of the main sources of information for 1 and 2;
4. An appendix which will include an analysis of the medical history of the family, showing the peculiarities which have, and have not, been transmitted, and their identical or changed form. All communications to be addressed to Francis Galton, 42 Rutland Gate, London (S. W.), England.

Mr. Galton has reduced the collection of statistics to a fine art, having arranged this schedule with the greatest ingenuity. The near and remote relationships are indicated by simple symbols; and, by means of horizontal and transverse columns, the required facts can be condensed into an astonishingly small space. Each schedule is intended to cover six periods in the life of the person described, from childhood to late in life, and at each of these periods to give a statement of, *A*, conditions of life; *B*, personal description; *C*, medical life-history. Under *A* are such topics as town or country residence, and sanitary influences generally. Under *B* are descriptions of feature and physique, of habits of work and muscular force and quickness, keenness of sight and dexterity, artistic and allied capacities, peculiarities of character and temperament. Under *C* are diseases, accidents, malformations, age at death, etc. Other facts solicited are, order of birth, age at marriage, number and sex of children. All this is upon one side of a double sheet, and relates to one person in the direct line of ascent. Upon the reverse of the sheet, similar inquiries are made in the collateral lines, or among the brothers and sisters of the person described.

Mr. Galton believes that the interest in each family

register will increase rapidly as the investigation goes on, and family histories will result of far more accuracy than could be collected in any less methodical system. The scheme is so much more comprehensive than any thing which has preceded it, that it certainly promises us a much deeper insight into the laws of heredity than we have at present. The moral value of this, and, in fact, of much of the life-work of this author, lies in the dissemination of the stern truth, which is as old as the Mosaic law, that the character of the next generation depends, perhaps, less than we are apt to think upon the education and training we prepare for them, and more upon the life-conduct of the present and the preceding generations.

HENRY F. OSBORN.

MAUDSLEY'S BODY AND WILL.

Body and will: being an essay concerning will in its metaphysical, physiological, and pathological aspects. By HENRY MAUDSLEY, M.D. London, Kegan Paul, Trench, & Co., 1883. 8+333 p. 8°.

CONSIDERED with respect to its announced purpose, this book is one of the most unfortunate and disappointing that we have ever seen bearing the name of an able man on the title-page. The purpose, as set forth on the titlepage and in the preface, seems indeed a noble one. Of will, in its pathological aspect at least, Dr. Maudsley has, one would suppose, the best possible right to speak. And we all have so much to learn about all its aspects, that we come to the book, even after previous experience of the author's eccentricities, with hope of getting some real instruction. That the freedom of the will is to be discussed, we learn without fear: for, old as the topic is, an ingenious man may have something new to say about it; and a straightforward statement of the doctrine of determinism, made from the physiological point of view, may well be useful and instructive, even if it should fail to be new. But, with much more interest than he feels in the promised wrangle over the freedom of the will, the student of psychology looks forward to what is promised in the preface, where Dr. Maudsley tells us that he has long been engaged in dealing with "concrete minds, that must be observed, studied, and managed;" that he has been trying to find out "why individuals feel, think, and do as they do, how they may be actuated to feel, think, and do differently, and in what way best to deal with them so as to do one's duty to one's self and them." In consequence, he says, "I have no choice but to leave the barren heights of speculation for the plains on which men live and move and have their being." He desires, then, "to bring home to mental philosophers the necessity of taking serious account of a class of facts and thoughts which, though they are

not philosophy, may claim not to be ignored by philosophy." All this means, if it means any thing, that we may expect from Dr. Maudsley some results of his experience with the laws of human will, some concrete psychology, — such, for instance, as, in case of certain phenomena of sensation and memory, Mr. Galton has given us, in the book that we lately reviewed on 'Human faculty.' Mr. Galton's work has been confined mainly to the lower phenomena of mind. How great the gain, if we can get scientific research to give us correspondingly fruitful results about the higher phenomena of mind! We hope, of course, for nothing final, or as yet very exact, in this field: but Dr. Maudsley will surely offer us something; and his announcement is just such as a sober observer of a special class of facts might be expected to make, in case he had found out something well worth telling. As for the author's denunciation of speculation, we need not be haters of philosophy to overlook or pardon that. The most enthusiastic student of general philosophy ought to admit freely the vast importance to him, also, of just such concrete study of mind as Dr. Maudsley announces; and if Dr. Maudsley has found the heights of speculation barren, then surely he will keep off them, and will tell us what he has to tell so much the better. We reserve, then, our own right to study general philosophy if we find it fruitful; and we just now follow him eagerly to the green pastures of concrete psychology, where he is to give us the result of special study.

We are doomed to bitter disappointment. The book consists of three parts. The first, on 'Will in its metaphysical aspects,' fills ninety-eight pages, and contains a restatement of the bare commonplaces of modern thought on the relation of mind and organism, a like restatement of the oldest and most commonplace of the deterministic arguments, a barren criticism of the oldest and most commonplace arguments for free will, and finally, scattered throughout this discussion in all sorts of wearisome digressions, a string of purely speculative reflections, so confused, so full of contradiction, so ill expressed, that they would be unworthy to pass as the thesis of a fairly instructed student of philosophy in his second year's work.

The second part of the book (pp. 99–232, with four pages of notes) opens far more promisingly, with a good chapter on the 'Physiological basis of will.' But thereafter, at once the discussion sinks back into its native confusion. We are to learn about the 'physio-

logical, sociological, and evolutionary relations' of the will; and we have a series of the commonplaces of recent discussion, together with another mass of confused speculations, as full as before of digressions. Mr. Spencer, who is not named, is yet several times referred to very severely as a dangerous speculator; but the most obscure expressions of Mr. Spencer's worst moments are bright sunlight to the gloom of these long and tedious sentences, and his speculations are surely as likely to be good as his rival's.

The third part, at last, on 'Will in its pathological relations,' leads us into the light once more. Here, at least, we have a few concrete instances brought together, and generalizations made from facts, and plainly stated. But how little we learn! The space left is short; and the author's lucid interval ends with the beginning of the last chapter, which he entitles 'What will be the end thereof?' and which he devotes to speculations on the way in which human life will degenerate before its final cessation on this planet.

And so, of the whole, only about one hundred pages, or less than one-third of the book, may be considered as having any real relation to the implied promise of the preface. The rest is simply the 'barren speculation' which we were to avoid, or else it is repetition in obscure language of what has many times been said in clear language.

But we must illustrate, for we are aware that a man of Dr. Maudsley's reputation might be expected to do better than we have here represented him as doing. First, then, as to the 'barren speculation.' Surely, if a man desires to let questions alone, he can very easily do so. Yet Dr. Maudsley goes out of his way, in the first part, to write a chapter on the 'Authority of consciousness.' He goes out of his way, we say; for, in so far as concerns his problem of the freedom of the will, the authority of consciousness might have been very briefly and specially treated. But, once having determined to take up the question generally, Dr. Maudsley runs on in this wise. Self-consciousness, he first tells us, is no more immediate knowledge than is the knowledge of external objects through the senses; since the latter knowledge consists of states of consciousness, as well as does the former. This, of course, is Kant's famous 'Refutation of idealism' in a nutshell. But now, both of these kinds of knowledge being knowledge of facts that are in consciousness, we ask what the truth of this consciousness is, or how we shall test its truth. We learn something about this matter farther on, on p. 41, where we find that

"there is no rule to distinguish between true and false but the common judgment of mankind," that (p. 42) "the truth of one age is the fable of the next," and that "the common mind of the race in me" — "common sense, which is more sensible than any individual in all cases (save in the exceptional case of a pre-eminently gifted person of genius)" — is the warrant to which we appeal for the truth of all our beliefs. This would look very much as if, in case one is not a pre-eminently gifted person of genius, one must be unable to know whether either he himself or the external world exists, unless he first discover that 'the common judgment of mankind' agrees with him that both do exist. This is a curious reversal of the familiar fashion of reasoning; since the 'mankind' to whom one is to appeal, surely belongs to the external world, to whose existence its 'common judgment' is to testify. Yet we must be doing Dr. Maudsley wrong. One must not take every statement so exactly. His real theory is expressed on p. 45. Here it is: "Every thing which we know is a synthesis of object and subject. . . . Neither *matter in itself* nor *mind in itself* are words that have any meaning. . . . The hypothesis of an external world is a good working hypothesis within all human experience: but to ask whether the external world exists apart from all human experience is about as sensible a question as to ask whether the shadow belongs to the sun or to the man's body; for what an extraordinarily perverse and futile ingenuity it is to attempt to think any thing outside human consciousness. . . . *To say there is an absolute* [the italics are ours], *and to call it the unknowable, is it a whit more philosophical than it would be for a bluebottle-fly to call its extra-relational the unbuzzable?*" P. 46 goes on to say, "A separation of subject and object cannot ever be the starting-point of a philosophy that is not a self-foolery." P. 47 adds, that what Berkeley called an idea "is a synthesis, the *ego* and *non-ego* necessary correlate." All this is perfectly clear by itself, much clearer than the text in which it is embedded; and the sense of it is, of course, pure phenomenism, such as Schopenhauer expressed in his '*kein objekt ohne subjekt*.' Matter is for consciousness, and consciousness is of objects. Spencer's unknowable is nonsense, — a product of perverse ingenuity, worthy of bluebottle-flies. One must not attempt to think of any thing outside of human consciousness; and so we have a doctrine.

No, not at all. Dr. Maudsley does not mean this. P. 51 is not far from p. 47; and yet, on

p. 51, the author assures us that "the external world as it is in itself may not be in the least like what we conceive it through our modes of perception and forms of thought." On pp. 52 and 53, Dr. Maudsley outdoes this contradiction by bringing the two contradictories face to face on the same open page, and affirming them both at once with childlike simplicity. "I don't want to think the *thing in itself*. . . . If it is out of me, it does not exist for me, cannot possibly be more than a nonsensical word in any expression of me; and for me to think it out of me, as it is in itself, would be annihilation of myself." But all this, says Dr. Maudsley, teaches him that there is a great deal outside of his perception, 'a real world external to me,' of which, however, he can say nothing. So Spencer's rejected unknowable returns: the mind is necessarily obliged to think what it cannot possibly think, to believe in what it perceives to be nonsense, and to assert in one sentence that 'self and the world cannot be thought apart,' and, in the next sentence, that the real external world is so far beyond self that self is wholly unable to make any assertion, save that it exists.

Now, this is not a collection of statements found in various authors, and brought together by Dr. Maudsley for the sake of illustrating the 'barrenness' of the subject. On the contrary, these are his own views. He himself chooses to write a chapter on this topic. He is bringing home to the philosophers something that they need to know. He is dealing with "doctrines arrived at by the positive methods of observation and induction." If not, what does the preface mean? and what has the innocent reader done, that he should be trifled with in this intolerable way? But if in reality Dr. Maudsley is expounding doctrines arrived at by the methods of observation and induction, these doctrines ought not to change nature with every new paragraph. These statements are deliberate and repeated, they are made with much show of earnestness; and yet they are a series of contradictions, and leave the reader feeling as if some one had been trying to make a fool of him. As for this doctrine, that it is "perverse and futile to think of any thing outside of human consciousness" (p. 45), how does Dr. Maudsley venture thus solemnly to propound it and enlarge upon it, when elsewhere, and not far off, he repeatedly insists upon the view that human consciousness is inexplicable, save on the basis of an *unconscious* mental life, which can *never be exhaustively known* at all? Is the relation of author and reader one that involves no responsibilities?

Were not this confusion of statement typical, we should not insist upon it. But throughout the book one finds, if not always such flat contradictions, still a certain slipperiness and uncertainty about nearly every general doctrine that the author chooses to express, on all but the most concrete matters of fact. If he says a thing, you know not when or how soon he will withdraw it, wholly, or bit by bit. He thinks, for instance, that the belief in the vanity of all things, or pessimism, is a 'malady of self-consciousness,' a sign of mental decay; but he adds, that the 'central truth of all religions' is a conviction of the utter vanity of all things, and himself seems in great measure a pessimist. Pure Christianity teaches the noblest virtues, — those, for instance, of self-sacrifice; but the only test of virtue is the experience and common sense of mankind; and these teach us that pure Christianity, put in practice without stint, would render society impossible, since society depends upon conflicts and selfishness even now. The noblest virtues are therefore those that are rejected when the only test of virtue is applied. And so we are led on.

The same tendency appears in the very style of the book. When the author has a definite opinion, he likes to conceal it from you under manifold cloaks of language. He dislikes Spencer's doctrine, that organic evolution is 'progressive adaptation to the environment.' This, he says, is too vague and one-sided a statement. His own statement avoids all vagueness by saying that (p. 137) "an organism and its medium, when they have reached a certain fitness of one to the other and hit upon the happy concurrence of conditions, combine, so to speak, to make a new start, the initial step of a more complex organism;" that is, the organism evolves by evolution, and the evolution is caused by just those conditions that bring it to pass. Our author expands this thought, which he intends as an important complement to the doctrine of natural selection, over quite a number of pages. But that, in the famous words of the Duchess in *Alice's Adventures*, is not half so bad as our author can do if he tries. Religion he defines (on p. 208) as 'the deep fusing feeling of human solidarity.' Certain beliefs common among men are described (p. 198) as "the imaginative interpretations of an instinct springing into consciousness from the upward striving impulse which, immanent in man as part and crown of organic nature, ever throbs in his heart as the inspiration of hope." Thus our author knows of an instinct that springs

from an impulse, which impulse is immanent in a crown, and at the same time strives upwards, and throbs in a heart as an inspiration. All this means, not mere carelessness of style, but a more serious error, else we should not have mentioned it here. It means haziness of thought; it means that our author can write many words in succession without knowing, in any adequate way, what they mean.

Our author's fashion of discussing things of which he is ignorant receives a crowning illustration in his last chapter; and, remote as the topic is from the main subject, we must mention this illustration here, because such matters are important to any student who is seeking a trustworthy guide. In this last chapter Dr. Maudsley has much to say of certain modern tendencies that he considers unhealthy. Of these, one is the excessive display of grief for the dead, which he thinks is growing among us. "Nobody of the least note dies but we are told with clamor of grief . . . that the most amiable . . . the best of men has been taken from us." But nobody, says Dr. Maudsley, is worth all this. "Contrast this modern incontinence of emotion with the calm, chaste, and manly simplicity of Homer; as we observe it, for example, in his description of the death of Achilles." Then follows a page of blank verse, which, of course, is offered to us as somebody's translation of the cited passage from Homer. Now, Dr. Maudsley was not obliged to say any thing about Homer, much less to quote him. He has gone out of his way to tell us, with an air of easily carried learning, what 'we see' in Homer. When a man thus pretends to quote the father of song, whose poems are at hand in all sorts of translations in any library, and to quote him especially for the sake of illustrating a certain important point, a reader supposes, of course, that the quotation will at least be a fairly accurate expression of something that Homer said. But, in fact, nothing resembling the passage quoted is to be found anywhere in Homer. These verses are not even so much as a remote imitation of any thing Homeric that bears upon Achilles. We ourselves are unable to identify them, but their tone is distinctly very modern; and we have little doubt that their author is now alive, or has very recently died.¹ But this is not all. To complete the blunder, Dr. Maudsley, in

¹ A classical friend, to whom we submitted Dr. Maudsley's quotation after we had written the above, assures us that the passage nearest to this one in ancient poetry is the death of Achilles as described in Quintus Smyrnaeus III., and that Quintus's description itself differs in so many important points from that of Dr. Maudsley's Homer as to make the latter not even a fair imitation of any ancient model.

this reference to Homer, has unwittingly chosen the worst possible illustration for his purpose, quite apart from his supposed quotation: for Homer does indeed tell us, in one passage (in the last book of the *Odyssey*), about the death of Achilles; but that passage informs us of a seventeen-days mourning of gods and men over the hero, with funeral ceremonies of extraordinary splendor, that would have done the dead man's heart good if he could only have been there to see. Nobody doubts Homer's simplicity, but Dr. Maudsley wholly misapprehends what it means. How he could have been so deceived in his quotation, we cannot guess; but such gratuitous blunders show us what to expect of a man that can make them.

If we have little space left to refer to our author's discussion of matters that he is eminently competent to discuss, that is not our fault. On the pathology of the will we receive instruction in the brief space before spoken of. Of heredity of mental disease we here find some illustrations, but we learn nothing new about the obscure subject of the actual laws that govern heredity. As to mental disease and its phenomena, Dr. Maudsley insists with considerable emphasis upon his view that the will, and in particular the most developed activity of the will, as seen in the moral consciousness of the civilized man, is the least stable, because the highest and latest element of man's mind, and must therefore show the signs of decay and disease soonest. This, he assures us, is actually the case. He illustrates his position by means of a good many instances of certain forms of mental disease. The view is not absolutely novel, and Dr. Maudsley has described most of the facts before. But all this is well worth telling, and would have made a useful essay if the rest of the book had reached the fire instead of the printer. As it is, this part of the book is the only one from which a student of such psychology as Dr. Maudsley so well describes in his preface can learn any thing of importance that is in any sense novel.

Our task in reading and reviewing has been no pleasant one. With Dr. Maudsley we hope for a psychology of 'concrete minds,' that may teach us "why individuals feel, think, and do as they do, how they may be actuated to think, feel, and do differently, and in what way best to deal with them so as to do one's duty to one's self and them." We see in the humblest experimental researches conscientiously conducted, in every observation of the mental pathologist, in every advance in nervous physiology, in every new discovery in animal psy-

chology, and, let us freely add, in every fruitful philosophic research into the deeper problems of thought, in all these things, not only aids, but necessary conditions of the approach to the great end thus defined. But we also see in vague rambling disquisitions *de omnibus rebus*, such as nearly fill this book; in efforts at philosophy by a man who is confessedly and very manifestly unable to understand philosophic terms, who ignores the history of thought, and who insists upon writing pages of contradictory statements,—in all this we see, not advance, but serious injury. And when not only the book is such as it is, but also the author is a man whose position and previous services command respect, and who is therefore able to call the attention of busy students to whatever he may choose to publish upon the subject,—then we say that such conduct is a serious breach of the privileges of authorship, and we wish to raise a decided protest against it. For the rest we have no quarrel with the author's determinism, nor with his materialistic basis for mental science, so long as he confines both the doctrines to their only proper sphere; that is, employs them as regulative principles in discussing and explaining the facts of experience. We quarrel only with his confused and purposeless fashion of discussion.

NOTES AND NEWS.

—THE report of the committee of the Geodetic association was presented at a general meeting of the conference, Oct. 23, at Rome, and was adopted after an animated debate. The report favors the universal adoption of the Greenwich meridian, and also recommends, as the point of departure of the universal hour and cosmopolitan dates, the mean noon of Greenwich. The conference hopes, that, if the whole world agrees to the unification of longitudes and hours by accepting the Greenwich meridian, England will advance the unification of weights and measures by joining the metrical convention of 1875. The government of Italy will be requested to officially communicate the foregoing action of the conference to all nations.

—In the October number of the *Harvard university bulletin*, further instalments are given of the geographical index to the maps in *Petermann's mittheilungen*, by Mr. Bliss, and of Mr. Winsor's 'Bibliography of Ptolemy's geography,' containing important notes on early American cartography. Mr. Winsor also commences an account, of which six pages are printed in the present number, of the Kohl collection of early maps in the Department of state at Washington, prefacing it with a brief account of Dr. Kohl's labors.

In the official portion of the bulletin, we find the following appointments gazetted: Arthur Searle as

assistant professor of astronomy; Robert H. Harrison, Harold Whiting, Charles E. Faxon, and Edward Burgess, instructors in anatomy, physics, botany, and entomology, severally; O. W. Huntington, assistant in chemistry, G. T. Hartshorn in organic chemistry, and G. W. Perkins in biology; and Dr. C. S. Minot, lecturer in embryology. The establishment of ten fellowships in the Lawrence scientific school, with an annual income of five hundred dollars each, is recommended by the corporation.

—The subjects to be presented at the Society of arts of the Massachusetts institute of technology the coming season will embrace a wide range of scientific and practical topics, arrangements having already been made as follows:—

Oct. 11, Professor Edward S. Morse of Salem spoke on Japanese pottery; Oct. 25, Professor William H. Brewer of New Haven read a paper on the evolution and breeds of domestic animals, as illustrated in swine; Nov. 8, Mr. Thomas Gaffield of Boston will read a paper on glass and glass-making.

At the subsequent meetings, the arrangements for which have not yet been definitely made, Dr. Charles S. Minot of the Harvard medical school will probably speak on some biological subject; Capt. D. A. Lyle, U.S.A., on the rise, progress, and methods of the U. S. life-saving service; Mr. Chauncey Smith of Boston, on the influence of inventions; Mr. R. B. Forbes, on the rigging of ships; and Major C. W. Raymond of the U.S. engineers will speak on Boston harbor. Various mechanical contrivances of interest will also be exhibited.

—A very valuable work on German meteorological bibliography has been prepared by Dr. Hellman. It contains a bibliography proper, limited to German authors, and also historical notices upon meteorological observations, and the progress of the science in that country.

—A free course of popular lectures upon zoölogy, specially intended for teachers and students, will be given by the Cincinnati society of natural history on Friday evenings, commencing to-day. The following is the programme: Oct. 19, Introduction, The study of zoölogy, by Prof. J. Mickleborough; Oct. 26, The human skeleton as compared with that of other animals, by Prof. J. Mickleborough; Nov. 2, The trochilidae, or humming-birds, by Charles Dury; Nov. 9, Fish fauna of Cincinnati, by Dr. D. S. Young; Nov. 16, Comparative anatomy of the mollusca, by Prof. A. G. Wetherby; Nov. 23, The mollusca from an evolutionary stand-point, by Prof. A. G. Wetherby; Nov. 30, Some curious insects, by Charles Dury; Dec. 7, Practical manipulation of the microscope, by Dr. J. H. Hunt.

When this is completed, a second course of equal length will be given on geology and mineralogy, the special topics of which will be announced later.

—Active movements are making to supply, as far as possible, the losses sustained by the Indiana state university in its recent fire. When the first meeting of the board of trustees was held, about a week after the fire, Monroe county was prepared to guarantee

fifty thousand dollars; and this, with over twenty-seven thousand dollars' insurance, gave the officials great confidence. No definite action, however, was taken, until a recent meeting of the trustees at Indianapolis, when it was decided to purchase a larger tract of land, just east of the city of Bloomington, much more favorably located than before, and to erect at once two fire-proof buildings, one of which can be used for the present for the literary department, and the other for the scientific department, museum, and library. Later, another building will be added, to which the literary department will be transferred, when the scientific department will occupy one of those now to be built, and the other will be given wholly to the museum and library.

For the present the university will occupy the old building, which was saved. It is reported that the trustees have in view the purchase of some valuable collections and a good library.

—A correspondent of *La Nature* gives a sketch, which we reproduce, of a group of French soldiers, as they appeared when resting on their marches in



Algeria, when they were obliged to stop on marshy land, and had nothing upon which to rest. The soldiers seated themselves each on the knees of the one behind, and were arranged in a circle, so that there was no end man. The correspondent vouches for having often seen the operation. *La Nature* recommends the collegians to try the experiment in equilibrium when they return from their vacations, —advice which it would hardly do to transmit to Americans.

—Trouvelot has made an examination of the sky near the place of the sun at the May eclipse, for the purpose of rediscovering, if possible, the red star which he saw at that time, and suspected to be an intra-mercurial planet.

In the re-examination, he used a telescope of the same aperture and power as at the eclipse. He found again, without trouble, his two 'white stars,' and identified them as forty-one Arietis and ϵ Arietis. As to 'the brilliant star of a pronounced red,' he says he could not find it, and that it is certain that no star of that magnitude and color now exists near the position assigned, nor even within a distance much greater than it is permissible to attribute to the probable error.

At the same time, seeing he failed to obtain a determination of its position, or to notice any disk or phase, he considers it only right to reserve any conclusion as to the probable nature of the object (*Comptes rendus*, Sept. 17). Astronomers generally will be disposed to believe, with those who observed the eclipse at the same station with M. Trouvelot, that his limits of probable error were, under the peculiar circumstances, some of which are mentioned in his original report, much larger than he seems disposed to admit, and quite extensive enough to include the star α Arietis, which was not far from the place he assigns, and in magnitude and color corresponds well with his description.

— The department of entomology, of the New-York state museum of natural history, issues a circular (no. 1) giving directions for 'arresting the chinch-bug invasion' of northern New York, with good figures of the insect enlarged and of natural size.

— Wood sections and vegetable tissue was the subject discussed by Mr. J. F. Whiteaves at the meeting of the Ottawa microscopical society, Oct. 16. Mr. Whiteaves was elected president, and Dr. R. J. Wicksteed secretary, for the ensuing year.

— Among the prizes given to American exhibitors at the International fisheries exhibition just closed, at London, gold medals were awarded to G. Brown Goode, for work on ichthyology; D. S. Jordan, for work on ichthyology; Alexander Agassiz, for work on ichthyology; J. E. Hilgard, for optical densimeter; Capt. C. Sigsbee, U.S.N., for deep-sea sounding apparatus; W. L. Bailee, U.S.N., for deep-sea thermometer; silver medals to G. Brown Goode, for publications relating to the fisheries; Marshall McDonald, for universal hatching-jar; Lieut. Z. L. Tanner, U.S.N., for deep-sea sounding apparatus; W. G. Farlow, for collection of marine algae; J. H. Emerton, for model of squid and octopus; T. H. Bean, for works on ichthyology; Marshall McDonald, for map showing shad fisheries; and diplomas to J. E. Hilgard, for salinometer; Capt. C. Sigsbee, U.S.N., for parallel ruler.

The United States receives 48 gold medals, 18 of which go to the fish-commission, mostly on collective exhibits, 47 silver medals, 29 bronze medals, 24 diplomas, and 7 special prizes. Other gold medals are to the national museum, for collective exhibit of fishes; signal-service, for most complete collection of apparatus for weather prediction; and lighthouse board.

— The French government has just issued a geological map of Algeria in five sheets, scale of 1:800,000, with two explanatory memoirs. This work is only preliminary; and appropriations have been made to organize a geological survey, which will make a careful and detailed geological map, first on the scale of 1:400,000, and then on a larger one, say 1:80,000, or even 1:40,000. The directors are A. Pomel, J. Pouyanne, and J. Tissot.

— Col. A. Parnell, R.A., states (*Journ. sc.*, September), that, as recorded by official returns, the number of persons killed by thunderbolts in Russia (not including Poland and Finland), in the five years from 1870 to 1874, was 2,270, of whom no less than

2,161 were dwellers in the country; and that during this period, in the same area, 4,192 fires were occasioned by thunderbolts, 4,099 of them being in the country.

— The speeches of Sir Lyon Playfair and Sir Charles Dilke, during the recent debate in the House of commons on the vaccination question, have been published by Messrs. Jarrold & Sons in pamphlet form, under the title of 'Facts about vaccination.' It is hoped that this little publication may prove a useful antidote to the present mischievous and ignorant agitation against Jenner's great discovery. The Cloth-workers' company, one of the old London guilds, has devoted a fund at its disposal for the encouragement of research to offering a prize of a thousand pounds for the discovery of a method of procuring lymph that would obviate the present objections.

— At a recent meeting of the Société d'encouragement pour l'industrie nationale, M. G. Meyer of Paris submitted specimens of paper specially manufactured to resist fire. It was stated by him that the papers and documents shown had been for four hours in a retort in a pottery furnace; and it is further affirmed, that those present were unable to distinguish, either by appearance or texture, the papers so treated from others which had not undergone the ordeal of fire. "From experiments made with a specimen of wall-paper sent us," says a writer in *Iron*, "we are enabled to say, that, although the appearance of the paper does change, the fire-resisting properties claimed for it are undoubted: the paper certainly does not ignite." The paper can be made of a quality suitable for deeds and other important documents, or of a quality suitable for wall-paper, theatrical decorations, or, in fact, for any purpose for which paper is used. Mr. Meyer has also invented an incombustible ink and incombustible colors. Artists using those colors may preserve their works to a certain extent. The invention would appear to be of the greatest value to theatrical managers. By using thick cardboard of Mr. Meyer's material, together with his paints, they are able to render their scenery unflammable. At the same time, for documents of importance, — deeds, wills, and agreements, — the invention should come into universal use.

— The catalogue of the Miller manual labor school was issued recently, bearing date of June, 1883. It is a neat pamphlet of some thirty pages, printed by the boys of the school. The school is situated in Albemarle county, Va., and was founded by the late Samuel Miller of Campbell county, who left property to the value of more than one million of dollars, to be expended in the erection of buildings, and the endowment of a school in which the students are to be instructed in the branches of a 'good, plain, sound, English education,' in ancient and modern languages, and in the useful arts. The school is now in operation, and a considerable number of students are in attendance, who are not only taught, but are fed and clothed, at the expense of the fund, which yields an income of sixty or seventy thousand dollars a year. Every student works in the shop, in the printing-office, on the farm, or in the garden. The workshop

is built from the plans of Mr. M. P. Higgins of Worcester, and a class of twenty-five boys is making good progress. The farm comprises eight hundred and fifty acres, of which a hundred and twenty are fine, rich bottom-lands in the valley of Mechem's River. The farm last year yielded an income of four thousand dollars. Boys are received at from nine to fourteen years of age, and are kept until eighteen.

—The White Mountain club of Portland held their autumn meeting, Oct. 17. The president (Rev. Dr. Thomas Hill) narrated his labors in identifying a mountain seen from Portland, and hitherto taken for the Imp. He finds it is a part of Carter range: the true Imp is scarcely visible. Still another 'Imp' is seen from Copp's house, near the Glen and Gorham road, where it is pointed out by stage-drivers, etc., as the south-west side of the true Imp. Cline's map correctly locates this as another peak.

—The collections of plants made by the late President Chadbourne, comprising thirty-four distinct lots, and containing among them some of interest and value, are offered for sale by his executor, A. Schenck, 30 Union Square, New York.

—Herr Hugo Zöller, who visited the Isthmus of Panama and the South-American states as correspondent of the *Cologne gazette*, has published his experiences in two books, the first called 'Der Panamakanal,' in which he contradicts the too favorable reports spread in the European papers as to Mr. Lesseps' work on the canal, and says his company has too little capital to accomplish the undertaking. He gives a map of the district, and fully expects to see the water-way a fact, and not an idea, within ten years, but not through Mr. Lesseps' means. The second book concerns Brazil, and is called 'Die deutschen im brasilianischen urwald.'

—T. W. Blakiston contributes to the *Japan gazette* of Sept. 8 an account of a voyage across the North Pacific, in the ship *Undaunted*, from Yedo to Victoria, V.I., between May 20 and June 21, 1883. Temperatures, winds, etc., were carefully noted, and the author came to the conclusion that the Kuro siwo at that season disappears between latitudes 37° and 39°, and west from east longitude 154°. Eastward from this point nothing was seen of warm water referable to that current.

—In a paper recently read before the Geographical society of the Pacific, some remarkable statements were made in regard to the Mahlemuts of Norton Sound, Alaska. Among other things, if correctly reported, the author stated that 'their customs and part of their language resemble the Chinese greatly.' The Mahlemuts are an ordinary small tribe of western Eskimo, who have been studied by a number of ethnologists, and in no respect differ from the other Eskimo tribes of the region. Such wild statements, especially when made before a scientific society, are almost invariably reproduced in European journals, and for that reason should be noticed and corrected.

—J. G. Swan, who has been investigating the Queen Charlotte Islands, returned to Victoria, Sept. 27. He discovered a fine deep-water fish, which is new to the food-supply of the coast, and is said to

occur in large numbers. He also reports finding a good harbor hitherto unknown.

—The volume of Washington astronomical and meteorological observations for 1879 has just been received at the naval observatory from the government printing-office, and will be distributed to correspondents immediately.

—A third edition, enlarged and improved, of Paetel's useful catalogue of mollusks, is announced. Though by no means available for text-book purposes, and with the usual allowance of errors, this publication cannot fail to be useful to all who have a large collection of shells to arrange, if it were only to furnish a workable foundation.

—The Iowa academy of sciences met at Ames on Sept. 27. Prof. C. E. Bessey of Ames read papers on the hybridization of *Spirogyra majuscula* and *S. protecta*; the effect of frost on leaf-cells, and on certain insect-catching glands on a grass. The glands referred to in the last paper are located on the blossom stems of *Sporobolus*, and secrete a viscous fluid, in which insects are entrapped. Their utility in these plants seems difficult to understand. In reply to a question by Professor Stalker, whether they could protect the blossoms from injurious insects, Professor Osborn said he thought they might possibly give protection from *Cecidomyia*. Professor Herrick of Grinnell described a water-still for obtaining a constant supply of distilled water in laboratories, and offered some observations on the Grinnell tornado, tending to show that at that point the tornado formed a loop in its course. Prof. H. Osborn of Ames offered some additions to the list of Iowa insects, in *Lepidoptera*, *Coleoptera*, *Hemiptera*, and *Neuroptera*; notes on *Mallophaga*, taken in Iowa; and a paper on an epidemic disease attacking *Caloptenus differentialis*. This last is a disease similar in nature to that caused by *Entomophthora muscae* in the common house-fly, and very fatal to these locusts. It is caused by a species apparently new, and shortly to be described by Professor Bessey in the *American naturalist*.

—The third and fourth parts of volume xiv. of the *Archiv für anthropologie* contain three original papers, as follows: on Hypertrichosis, by Dr. Ranke; on the eyes of the Fuegians, by Dr. Seggel; and on copper in ancient times, by Dr. Reyer. Reviews of the anthropological literature in Russia are prepared by Dr. Stieda; in Scandinavian literature, by Miss Julia Mestorf; in American literature, by Dr. Emil Schmidt. The last named covers twenty-three closely printed quarto pages, and embraces about every paper of importance published in our country during the last year, relating to anthropology. The bibliography occupies 161 pages, and many of the titles are accompanied by a brief note stating the purpose of the publication. It is a thorough piece of work, and is distributed as follows: archeology and prehistoric history (*urgeschichte*), by J. H. Müller, 41 pages; anatomy, by Dr. Pausch, 6 pages; ethnology and travels, by Dr. Albrecht Penck, 90 pages; zoölogy in relation to anthropology, by Dr. George Boehm, 23 pages.

Students in all branches of science know how diffi-

cult it is to find the thing they are seeking. Between those piled up and stowed in great collections and those hid away in private museums, much time is wasted. Now, the anthropologists of Germany long ago felt the necessity of publishing the catalogues of the specimens in their great museums; and already have appeared five of these in former numbers of the *Archiv*. The current number devotes 36 pages to the Senckenberg museums in Frankfurt-a.-M., with tables of measurements and descriptions; and 25 pages to the anthropological collection in the Grossherzoglichen naturalien-cabinets im alten schlosse, in Darmstadt, also with measurements and descriptions. Comparisons, of course, are always odious; but it cannot fail to strike our American anthropologists that the especial merit of the German system, that is, co-operation, is wanting with us. It may also be mentioned that none of the foreign anthropological societies seem to know any thing about the work in progress at the surgeon-general's office at Washington.

— There have been issued by the government, under the direction of Gen. W. B. Hazen, chief signal-officer, the meteorological and physical observations on the east coast of British America, by Oray Taft Sherman, as no. 11 of the 'professional papers.' Nos. 8 and 12 consist of papers on the 'Motions of fluids and solids' and 'Popular essays on the movements of the atmosphere,' by Prof. W. Ferrel; the first edited, with notes, by Mr. Frank Waldo. No. 9 contains charts and tables showing the geographical distribution of rainfall in the United States.

— The new British patent law will go into effect Jan. 1, 1884. The patent fee is reduced to about a hundred dollars for all fees, including agents' ordinary charges. Provisional protection is extended to nine months. Annual taxes are substituted for the stamp-duties now charged, although no change has been made in the total amount. The new provisions apply to applications now in the office. No change has been made in regard to examinations. The patent is issued to any applicant who chooses to pay the fees, and without formal examination. A system of comparison of the patent claim with the claim for which provisional protection has been granted, is, however, established, — a commendable innovation, and one which might well be supplemented by the system of complete examination practised in the United States. The duration of the patent is to be fourteen years in all cases, irrespective of the expiration of earlier foreign patents on the same device. The publication in Great Britain of the foreign specification of the invention does not, under the new law, invalidate the British patent. The new law will evidently greatly favor the inventor, and the change will be likely to prove to be very greatly to the advantage of that country as well.

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